

AUGUST, 1942

ORGANIC FINISHING

SECTION OF METAL FINISHING



QUERING • ENAMELING • JAPANNING • PAINTING

WHERE FAILURE IS FATAL FINISH MUST BE RIGHT



- Steel for shell cases to conserve brass brings new problems. Finishing these new steel shell cases is one of the most critical jobs in industry, today. The inside of the case must be made resistant to corrosion and other damaging effects, not only under usual storage conditions in any climate, but under firing conditions.

Working with the Army from the inception of the project, Zapon created a new coating, S-198-C, that successfully met the rigid requirements. There must be no compromise with quality specifications on such an important job.

Makers of shell cases also must insist that the finish they buy meets all specifications. There must be no duds in finishing.



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Reclamation of Solvents Vital

Millions of gallons of valuable solvents, which are now discarded, can be reclaimed for further production purposes. An educational program has been initiated by the Bureau of Industrial Conservation of the War Production Board to make certain that all users of solvents take advantage of the facilities available for reclaiming and recovering the same.

In the finishing industry these solvents would include cleaning naphthas, washing thinners and metal degreasing solvents, such as trichloreethylene. It is also possible to reclaim other solvents, such as alcohols, esters, ethers and ketones, all of which are important in the war effort. The various processes for reclaiming solvents may include such operations as filtering, frequently with the use of activated carbon, washing and decanting, centrifuging and distillation.

Metal Finishing will be pleased to give the names of companies specializing in solvent recovery to anyone asking for the same.

The cost of reclamation of the solvents is considerably less than the cost of even low-priced solvents, and in view of the very critical nature of the solvent supply, finishing room foremen and executives should insist that solvents be used with view to economy, and every effort be made to reclaim the same whenever recovery is possible.

Some of the solvents included in Group 1, the very critical materials, of the report issued July 6th by the Conservation and Substitution Branch of the Bureau of Industrial Conservation are: acetone, benzol and toluol. Included on this list are also other basic substances used in the manufacture of finishing materials, such as cresylic acids, phthalic anhydride, phenol, tricresyl and triphenyl phosphates, oiticica oil, phenol formaldehyde resins, polyvinyl chloride, chlorinated rubber, shellac and tung oil. Obviously, every effort should be made to use materials containing these substances with greatest economy.

NEWS FROM WASHINGTON—

Appointment of E. H. Bucy, Noroton, Conn., to head the Protective Coatings Section of the Chemicals Branch, WPB, was announced recently by Dr. E. W. Reid, Branch chief.

Mr. Bucy joined WPB January 7, 1942, and has been head of the paint, varnish, lacquer and printing inks unit of the section. He has severed his connection with the Zapon Division of Atlas Powder Company, of which he was technical director in charge of research and development, to accept Government employment on his new job. Mr. Bucy has been with Atlas Powder since 1934, prior to which he was chief chemist for the Waukegan Chemical Company. He holds a number of chemical and mechanical patents and is author of numerous technical articles.

Mr. Bucy replaces J. B. Davis, who has been loaned to Brazil for the development of babassu nut oil production in the Amazon area.

Wells Martin, Chicago, will be assistant chief of the section under Mr. Bucy. He is former president of the Martin Varnish Company of Chicago and also has

Ethyl cellulose was placed under complete allocation control by General Preference Order M-175, issued June 18. This action is taken to provide adequate supplies for military and essential civilian use and to prevent its use for purposes where substitutes are available.

By the terms of the order, no person may deliver, and no person may accept delivery, of ethyl cellulose except by specific authorization of the Director of Industry Operations. Deliveries of 50 pounds by any one person to any one other person in one month are excepted.

Orders for quantities in excess of 50 pounds must be filed with producers on or before the 15th of the month preceding the month in which delivery is desired, accompanied by Form PD-550. Producers must file with WPB on or before the 20th of each month, beginning with June, 1942, Form PD-549 showing a schedule of deliveries and a statement of the amount of ethyl cellulose available for delivery in the succeeding month.

Ethyl cellulose is used in lacquers, coated textiles, and plastics. It has the properties of non-inflammability, resistance to heat, grease, and oil, and forms a tough, flexible coating on the surface to which it is applied. It is a comparatively new product, being manufactured by only a few producers, and is used for a variety of military and civilian purposes.

While production is now larger than ever before, orders carrying preference ratings of A-10 or higher are drawing off stocks for which comparatively plentiful nitrocotton, pitch, tar, or other substitutes are available. This order is issued to prevent its use in places where substitutes are adequate.

Repainting and redecorating without specific authorization are permitted under the terms of Conservation Order L-41 when they constitute "maintenance" or "repair," the War Production Board stated recently.

Conservation Order L-41 places all civilian construction under rigid control. The intent of the order is to reduce non-essential construction to a minimum so that all possible material, equipment and effort will be available for use in direct war production. To comply with this, all construction work—including repainting and redecorating—which is not absolutely necessary, should be deferred for the duration.

In drawing the order the War Production Board made

allowances for ordinary maintenance and repair work to return a structure to sound working condition without a change of design. Changes in material or type of equipment are permitted if the architectural or structural plan is not substantially altered in effecting the change.

Thus, repainting and redecorating needed to maintain an apartment, home or office in reasonably satisfactory condition or to return it to that condition is permissible. For example, if a new tenant occupies an apartment, home or office which has been left in an unsatisfactory condition by the previous occupant, the landlord may redecorate. Also ordinary redecorating which is done as part of a customary maintenance program is permissible.

To enable steel drum manufacturers to use some 150,000 gallons of exterior drum coating which they have on hand, the use of which was forbidden by Conservation Order M-158, an amendment to the order was issued recently by the Director of Industry Operations.

The amendment also limits application of the order to drums made of 29 gauge or heavier steel, the intention being to exclude from the order such containers as tin cans.

Any "Class A" coating, those containing tung, oiticica, perilla or dehydrated castor oils; alkyd, phenolic, vinyl, urea or melamine resin; cellulose esters or ethers, or pigmented coating which was manufactured on or before June 5, 1942 may be used on drums without limitation. The amendment also permits use of pigmented coatings of any color on either or both ends of drums, or upon the sides, where required by Government or underwriters' regulations, and the use of clear as well as black coatings without restriction. The original order limited colored coatings to one end of drums only, except where required by Government or underwriters' regulations.

This action is taken because these drum coatings are suitable for no other purpose, the materials in them are not reclaimable, and it is felt that further restrictions on existing stocks would serve no useful purpose.

To direct available supplies of phosphate plasticizers into the manufacture of war-essential flame-proof cable, anti-fouling paint, airplane dopes, wire insulation, photographic film, and other plastics, the entire supply, production, and use of such plasticizers has been placed under complete allocation control by the Director of Industry Operations with General Preference Order M-183.

After August 1, 1942, no phosphate plasticizers, defined as tricresyl phosphate and triphenyl phosphate in any form, may be used, delivered, or accepted without specific authorization by the WPB. An exception is made in the case of deliveries or use of 100 pounds in any one month to one person, provided that producers may not deliver these small shipments in excess of two per cent of the total amount WPB authorizes them to deliver that month.

All persons except the military seeking authorization for use or delivery of phosphate plasticizers, must file Form PD-558 with WPB on or before the 15th of the month preceding the month in which delivery is sought. Producers must file Form PD-557 on or before the 24th of each month, beginning with July.

The supply of phosphate plasticizers is limited by materials, not plant facilities. While we appear to have productive capacity greater than our needs, production may not be quite adequate because of tightness of phenols, cresols, and other materials. Civilian demands, with the possible exception of photographic film, have already been cut to the minimum, and it is not the intention of this order to cut civilian uses further, but rather to direct available supplies into the most highly desired war production channels. It is estimated that over 95 per cent of tricresyl phosphate shipped during April, 1942 was shipped on orders rated A-1-j or higher.

The Status of Organic Finishing Materials

Formulation, Applications and Availability

By CHARLES A. LANKAU, Ph.D.

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This valuable paper should be read by all those engaged in the use, selection or purchase of finishing materials. It explains why materials are short and why the quality and availability of finishing materials are constantly in a state of change. The relation between raw materials for finishing material manufacture and strategic war materials is stressed. Government specifications for organic coatings to be applied to ammunition and naval aircraft are discussed. Various finishes available as substitutes for plating or for protecting or enhancing the beauty of essential civilian products are described.
—Ed.

Introduction

THE subject of this paper is of importance to the platers and metal finishers, particularly those who are converting to new fields in our war effort and to those who are attempting to finish up their allotments for civilian business. The coordination and the interdependence of the three topics—formulation, application, and availability—are greater than ever before in history. They are so related that a separate discussion cannot be properly made, and it will be found that all that is said about one is dependent upon or precluding some fact about the others. The rapidity with which regulations change thru the issuing of new orders, new addenda, and order clarifications makes it impossible to state with any degree of certainty what may be the availability one hour after a statement is made. It is with this understanding that all statements made here should be taken, as they may be all past history between the writing and the delivery thereof.

It would be much more gratifying to appear before the convention under more favorable circumstances to discuss the various types of finishes and

their uses, to point out the new developments and advancements in the field, and to acquaint the users of finishes with some of the properties which would aid them in choosing the best possible materials to protect their wares under the particular conditions to which they will be subjected and under their own conditions of application. We do not come before you with any degree of optimism, nor can we indicate any sign of relief for those who are engaged in strictly non-essential, civilian business. We are faced with the grim efforts of war-time production. Our all-out effort is reflected in all industries and is carried from the most important, right on down to the least important. Many non-essential industries are completely closed down and others will be closed in a short time. This is a very dark picture and is a very serious situation for those affected; but we must consider the whole war effort in estim-

ating the value of these sacrifices. Surely, if a hardship on a few will mean the salvation of the entire nation or even the world or even the shortening of the massacre by a few days or weeks, the hardship is not too great. Thus the quality of finishes available for relatively non-essential products or the added drying time for even the essential products is not too great a hardship or sacrifice to make in our all-out effort to win the war. These points will be enlarged upon but are mentioned here to show their relation to the picture.

Scarest Ingredient Determines Availability of Finished Product

The availability of any type of finish is directly related to the availability of the scarce ingredient in the formula. Thus it follows that the type of material in question is available to the extent of the priority rating which the finished article carries. Those articles which are for civilian use and do not carry a priority can be finished only with materials which can be supplied without priority and, in some cases, even with restricted quantities of them. For specific examples, see the General Limitation Order L-81 regarding toys and games, issued March 30, 1942, and General Limitation Order L-113, issued May 2, regarding pencils. These orders not only limit the materials which can be used but also the quantity the finisher may use per unit number of finished articles.

The fact that the products of the manufacturer are covered by priority ratings and that these ratings may be

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Dr. Charles A. Lankau

extended upon the supplier of finishing materials does not necessarily mean that the regular grade which has been used for some time can be supplied. The degree of rating is an all-important factor. During the early periods of the O.P.M. priority regulations, it was in practically all cases possible to obtain materials with any rating; the only restriction being in the order of filling the requests. Thus a very low rating would obtain the necessary materials after all the higher rated orders were filled so that eventually the materials were received even though it often entailed long delays.

It was soon found that not only were there often insufficient materials to fill the low rated and non-essential orders but also that some of the raw materials were being used to too great an extent so that curtailment in other materials made from the same raw materials was necessary. In order to prevent this, the O.P.M. and now the W.P.B. have issued new regulations whereby certain strategic materials are available only on certain high rated orders and in some cases only on direct Government order issued by the W.P.B. For example, certain materials are available only on A-10 or better, others on A-3 or better, others on A-2 or better, and still others only on direct Government allocation. Toluol, aluminum powders, and chlorinated rubber fall in the latter category. You may, therefore, readily understand why in certain cases you may be told that your rating is not high enough to obtain certain materials. Your recourse is to apply for a higher rating from the War Production Board or accept a substitute.

The availability of finishes for articles which are considered non-essential civilian is small. The number of types is smaller and is rapidly being reduced. Nevertheless, there are still some finishes available and some will continue to be available for non-essential business until every conceivable raw material has found sufficient use in the war effort to use the entire available supply. The technicians and engineers in the finishing materials industry are keeping the lights burning in the development laboratories in their efforts to find new materials or new uses for old materials in an attempt to supply finishes to the dwindle-

ing non-essential industries. Their source of basic materials or metals is shrinking and an effort is being made to keep finishes available until these materials are completely exhausted. It should be understood that the quality of these finishing materials may not be of the high order of excellence to which industry is accustomed. In fact, they may be quite inferior in some cases, but will, for the most part, suffice as a protection against corrosion, tarnishing, etc., to a reasonable degree. The main effort of these research engineers, however, is exerted toward winning the war. Finishes for direct military requirements, Government agencies, and essential defense industries receive the preferred attention and require the main efforts of the research engineers.

Types of Finishing Materials Changing

A consideration of the changes that are rapidly taking place in the metal finishing materials industry and the nature and source of its raw materials will clarify the availability situation. The metals industries in cooperation with the war program are making effort to conserve scarce metals both by voluntary patriotic action and by Government order. This entails using these metals where they will be of greatest value to the war effort. Many of the essential goods, therefore, may be made of inferior materials in order to conserve the better materials for the more important of these essential goods. These may require a protective finish to guard them against corrosion, deterioration, destruction from the elements, from handling, or from normal use to which they are subjected. The less important of these which are now to be made of inferior materials will be of even greater need of a protective coating.

Therefore, the coating materials industry must now supply finishes for new requirements, new surfaces, and out of new or substitute raw materials as well as of some of the old. This makes the problems more complex. These finishes are needed immediately and must be abruptly changed as certain raw materials are cut off or restricted from use for the requirements in question. Thus the usual time-consuming tests and small scale practical usage prior to the commer-

cial production of new and different finishes must be practically abandoned. The net result is that both manufacturer and consumer must in full co-operation anticipate some difficulties with materials which cannot await to be fully tried and tested products. The raw materials used by the manufacturer of finishing materials include various cellulose derivatives, natural resins, synthetic resins, chemical plasticizers, oils of the oxidizing and non-oxidizing types, pigments, driers, rubber derivatives, condensation products or polymerization products of certain unsaturated organic chemicals and miscellaneous chemicals used as wetting or dispersing agents, detergents, and catalysts, etc., as well as a host of solvents. This is but an abbreviated list of the many materials that may go into the formulation of finishing materials.

When considering the raw materials from which these ingredients are made or the geographic source of the natural materials and then comparing with a list of those materials which are either used in the manufacture of strategic war materials or are used as raw materials for products which find use in essential industries, it is readily understandable why the availability of the final finishing material is limited, restricted, or prohibited. For example, nitrocellulose requires nitric acid and sulfuric acid as well as pure cellulose, from cotton or wood, in its manufacture. Nitric acid as well as the main parent substance, ammonia, are both used in the manufacture of explosives such as trinitrotoluene (T.N.T.) etc.

The alcohol which is used to wet the nitrocellulose to render it less hazardous for handling is also used as a solvent in the manufacture of explosives. Nitrocellulose in its manufacture may very readily be nitrated slightly further to make the explosive gun cotton. Toluene which is used as a solvent in synthetics or as a diluent in lacquers is a basic substance for many explosives, the most common of which is T.N.T. And certainly, if these ingredients are as important in the war effort as indicated and there should be a shortage of any, it is far more important that it be used to blow to destruction a few Japs or destroy enemy equipment than to be solicitous that our finishes are the most convenient or less satisfactory.

We are glad to make the sacrifice. We are perfectly willing to have drying schedules slowed a slight degree. We are content with up to 5% greater reduction with solvents, resulting in slightly poorer appearance without loss of proper protection if the results in the war effort are as indicated. Even these handicaps are rapidly being overcome by new developments and the sacrifice appears to be only temporary.

Close Relation Between Raw and Strategic Materials

Further examples should not be necessary but will show the different ways in which the raw materials are related to strategic materials. Other cellulose derivatives likewise require materials which are either important in manufacture or use in explosives or other military products or may be converted into materials which can be so used. Synthetic resins require such materials as phenol or phenol derivatives, urea or related nitrogen-containing products, formaldehyde, maleic anhydride, phthalic anhydride, glycerol or related polyhydric alcohols, sebacic acid and other polybasic acids and various modifying oils, all of which are basic materials useful in one way or another in the war production program.

The same may be said of the driers, chemical plasticizers, solvents, and miscellaneous chemicals. Oils and natural resins, on the other hand, are restricted or limited largely because of the geographic location of their source as well as any uses in the war effort. Many of these are imported from the Far East from which it would be exceedingly difficult to transport due to the present area of conflict in addition to the present shortage of shipping facilities. The combination of both factors results in an importation of these products which is negligible for all practical purposes. We, therefore, are confined to the present available supply now in this country so that we must make every effort to enforce a conservation of a diminishing supply.

It would be preposterous to discuss rubber derivatives in view of the present generally accepted rubber situation. Condensation products or polymerization products of certain unsatur-

ated organic chemicals may be used as raw materials for the manufacture of synthetic rubber or rubberlike materials. Their present importance is generally known.

Pigments may be classified in many ways but many of them are complex compounds of certain metals, for example, lead chromate. The metallic content is such that the material may be more important as a source of metal than for use as a pigment. Then, too, it must be remembered that any of the above may find valuable use in finishing materials for articles which are much more important to the war effort than those in which we are interested, so that even though they may be allocated for finishing materials, they may be restricted to only the uses of prime importance and utmost necessity.

The above few of the very many facts may show the working mechanism of the allocation system and reason for the restricted uses of many of the materials used in organic finishes as well as indicate the complexity of the inter-relation of the many ingredients to our all-out effort to win the war. It will show some of the difficulties encountered in the formulation of products to meet your needs. It will justify the offering of substitutes and substitutes for those substitutes as the availabilities change from day to day, due to some new essential requirements, allotments, or restrictions. It will demonstrate the importance and necessity that the finishing materials supplier be familiar with the end-use or exact nature of the product upon which it will be placed as well as the priority rating available and the usual knowledge of the finishing schedule or facilities that are available.

Formulation of organic finishes at present, as it has been clearly shown, is dependent practically entirely upon availability. It may even be said that it is a function of availability. Some materials are completely prohibited (except by direct allocation by the War Production Board) for the duration of the emergency. Such items as chlorinated rubber, certain products of polymerizable, unsaturated organic compounds, and toluene fall in this classification. There are several more optimistic points to be considered by the present non-priority business.

Those engaged in purely luxury business will, of course, not continue along those lines but some of the other non-essential products are finding some use in our defense setup so that they may continue on a reduced scale and carefully regulated procedure. Consequently, many of the seemingly unimportant objects are becoming necessary to the war program and are gradually being granted priorities for the number of articles considered necessary. Formulation for these materials is being carried on without interruption except, of course, to substitute less critical materials for the more critical ones. It is safe to say that there are finishes for practically every surviving requirement even though many of them are inferior to some degree. For example, for certain types of work, white enamels can only be made in such a way that they will yellow badly on aging, other materials will be slower drying, still others will have softer surfaces, lacking the surface hardness and mar-resistance usually desired.

Finishes for War Work are Rated

For those engaged in war work whether directly or as a sub-contractor and having priorities, formulation of the finishing material is again dependent upon the degree of priority which the final product merits. Those having A-1-a can obtain any finishing material containing any ingredient except those few which are available only on direct Government order, and subject, of course, to the regulations covering the particular trade. Such regulations as the machine tool order, General Limitation Order L-108, issued April 27, 1942, restricts the number and type of coats that may be applied to machine tools and metal working equipment of practically all kinds including bullet making machines. Those rating lower than A-1-j cannot obtain their materials in tin cans regardless of the stability of the material in any other container. Neither can they obtain materials which contain cresol or cresol derivatives. Included in this class are certain bakelites, lindol plasticizer, etc. Those rating lower than A-2 cannot obtain products containing chinawood or tung oil whether incorporated as such or as a combined portion or as the modifying portion of the resin used. Certain bakelite type res-

ins containing chinawood oil fall in this class. Articles rating lower than A-10 have small chance of obtaining materials containing phenolic resins, ethyl cellulose, cellulose acetate, and nitrocellulose although small quantities of some are available for lower or no rating. Urea formaldehyde and melamac resins require a "formaldehyde statement" which states that these resins will be used on war or essential civilian products only. They should be used on products rating B-4 or higher.

Production Ratings Plan Helpful

This system of priority rating is rapidly being changed as manufacturers file their P-25-A forms with the War Production Board to obtain a blanket P-90 rating which operates under the Production Requirements Plan. All manufacturers are advised to consult their W. P. B. headquarters regarding the mechanism of the operation of this plan. It is suggested that all metal finishes or manufacturers requiring the use of organic finishes do not overlook this item when making out that form. It is further suggested that you inquire of the finishing materials manufacturer with whom you are dealing just what rating is required for each of the finishes you will use. This will enable you to determine what percentage of your finishes require A-10 and what percentage A-2, etc., so that you will obtain the necessary blanket rating for all your finishing requirements in advance to enable you to obtain the correct quantity of the proper finishing materials.

Availability Continually Changing

Some manufacturers have found it impossible to obtain their regular finishes and have been obliged to accept substitute materials. Some of the substitutes have been found superior to the regular materials, others inferior. The explanation of this has been given above. These substitutes remain available until a new shortage exists and then a new substitute is given. The substitutes which are superior will remain available until their value to the war effort is recognized, at which time they will be required for defense or essential civilian requirements and will be placed on the priority list. As this occurs, the original material may again

become available for the less important usage or it may be necessary to find a new substitute which is either readily available or which has not yet found its value in essential industries.

Reasons for Higher Costs

One of the more general changes in the field of organic finishing materials is the tendency toward somewhat slower drying or longer initial setting-up period. This is caused by a change in available solvents. Such relatively fast evaporating solvents as toluol, ethyl alcohol, ethyl acetate, low fraction petroleum naphthas, etc., are either unavailable or available only in limited quantities. This leaves only the slower and more costly solvents to substitute either in whole or in part, with the net result that the finishes set up or dry somewhat more slowly and simultaneously raise the cost. In addition to the use of more costly type materials, the cost of all materials including these already more expensive ones, the higher transportation and packaging costs, and increased labor costs as well as additional sales expense, taxes, etc., all taken together show a decided difference in final prices. And in full cognizance of this, the products may still be inferior. Under ordinary circumstances it might be said that "it does not add up." But, gentlemen, this is war and these are just some of the minor sacrifices we must make in our full determination to win the war.

Government Specifications

Some of the platers are now engaged in the manufacture of articles which require finishing materials meeting certain Government specifications. A few words concerning the formulation and use of the more important ones may be of some assistance to the platers and metal finishers.

Paints for Ammunition: — U. S. Army Specifications 3-162a, 3-67e, 3-106e, and Frankford Arsenal Specification FXS-284 are the more important of these. The 3-162a is a nitrocellulose lacquer base material furnished in any of the army colors in the 3-1E color group in an eggshell sheen. It is used on the exterior of shells, bombs, grenades, and any other objects requiring a quick drying finish, one coat directly on the metal.

It is usually applied by spray application and is especially suited for automatic spraying machines for production work and is usually furnished to be thinned equal parts with lacquer thinner for spray application, or may be furnished ready for use. It is satisfactory for many parts or small objects requiring medium protection and identifying color.

The 3-67e is a slower drying oil base or synthetic paint for similar use to the 3-162a and is furnished in the same colors. Type I is ready-mixed, suitable for brushing and type II can be reduced 4 to 1 with naphtha for spray and will airdry or bake.

The 3-106e is an acid-proof black paint for ammunition components. It is supplied in 3 types; namely, I. Spraying and brushing, sets to touch in 15 minutes, and dries hard in 45 minutes; II. Brushing only, sets to touch in 2 hours and dries hard in 8 hours; III. Heavy paste, which sets to touch in 8 hours and dries hard in 24 hours.

Naval Aircraft Parts & Accessories. L-12b and P-27b-2 are the outstanding numbers in this classification. The L-12-b is a high resin phthalate lacquer obtainable in all A-N colors and is usually applied on P-27b Primer or some other zinc chromate primer acceptable to the Navy. It is an exterior protective coating for metal and is usually applied by spray application. It is used on many parts such as lamp housings for bombers to instrument panels and miscellaneous parts. It dries like any lacquer material. This is an ingredient specification and does not vary. For some items of similar use, other lacquers of similar performance are permitted and these are formulated to best advantage for the particular requirements for which it is to be used.

The P-27b-2 is a zinc chromate primer, also an ingredient specification. It can be applied by spraying, brushing, or dipping to deposit a semi-transparent film. The reduction required is dependent upon the application conditions and is recommended specifically for the use to which it is to serve within limits set by the specification. The particular formulation is known to settle quite readily so that manufacturers often use zinc chromate primers of different formulation but of equal

performance when permitted by the Navy.

These few specific examples should suffice to show a little of the wide variation of formulation entailed in a few of the most common specification materials. For details of requirements for any particular finishing problem concerning Government specifications, the finishing industry in general has set up departments that will gladly consult and give any necessary technical information. The manufacturers of goods for Governmental requirements should avail themselves of this service.

In order to conserve plating materials and scarce metals, they have been replaced by plastics of numerous kinds and types, by imitation leather cemented to base metal and by organic finishes of various types applied directly to the base metal.

Substitutes for Plating

Some of the suggested organic finishes which may be considered as substitutes or additional devices for protecting or dressing up the product to have additional sales appeal without the use of plating materials, involve transparent colored lacquers which may be applied over polished base metal to give various effects simulating plated ware. The more highly polished or brilliant the finish of the base metal, the clearer or more brilliant will be the final product. Any degree from dull colored finish to a bright clear colored finish may thus be produced.

For articles which require the maximum of rust inhibition and where

opaque colors may be used, a light coat of zinc chromate primer may be applied. This may be air-dried as long as desired and baked out when convenient, as it air-dries for handling in 20 minutes to a half hour but requires baking for maximum adhesion and protection. This may be followed with an air-drying lacquer enamel or baking synthetic enamel to give any desired color or finish that may be required. Those articles requiring decorative value either instead or in addition to protection will find additional changes worthy of consideration.

Since metallic powders of all kinds are unavailable for usual metallic finishes, some manufacturers have substituted pearl essence with or without color for the metallic finishes. In place of the usual texture or hammered finish others have substituted spatter or webbing finishes over a contrasting color base enamel. Many of the finishes are more costly than the old finishes but the added cost is absorbed in higher selling prices which are more or less general in all industries.

The application of the clear finishes may be of various types, depending largely upon use to which the object is to be put or the appearance that is desired. For small plated articles which are manufactured in large production and which require protection more than appearance, a bulk dipping process may be used. The objects may be placed in wire baskets and dipped in the thinned lacquer, then withdrawn and permitted to drain or placed in a centrifugal machine. The objects are

then spread out on trays for final drying.

For objects requiring a smoother finish over all parts where a thin film will suffice, they may be placed on suitable racks and dipped more or less individually in automatic dipping devices of various designs. Objects requiring the maximum of smoothness with fairly heavy films only on parts which can be seen may be finished by spray application as individual parts or may be sprayed in bulk on trays. The transparent colored lacquers can best be applied by spray application to insure uniformity of color throughout.

The application of zinc chromate primers may be made by dip application or spray application. In either case it is necessary to apply only a thin film which may not completely hide the metal just as long as the film is continuous without breaks. Complete hiding of the metal is satisfactory but not necessary for maximum protection. After ten to twenty minutes air-drying period, the primer is ready to receive lacquer or synthetic enamel top coats by spray application. If the enamel coats are to be applied by dip application, the primer should receive an air-dry period of at least an hour and preferably be force dried or baked prior to dipping in enamel.

Metal lacquer enamels may be used directly on base metal or where maximum conditions of adhesion, rust-inhibition, and durability are required used over the correct primer. The enamels may be used over the entire object as the sole coating or they may

The Buy-Word Is "Enthane" for ENAMEL STRIPPERS

For the past 4 years Enthane strippers have been used by hundreds of manufacturers for quickly removing organic finishes from civilian goods.

And NOW—fast working, patented* Enthane strippers are helping to speed the flow of war goods.

Here's what Enthane strippers do:

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- ★ Leave all metals clean and bright.

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TELL US YOUR PROBLEM!

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CUT DOWN REJECTS WITH

ORVUS

IN YOUR METAL CLEANING BATHS

This sulfated fatty alcohol Cleansing Agent is EFFECTIVE

- as a surface tension lowering agent
- as an emulsifier

—in dispersing lime soaps which might cause poor plating results if permitted to deposit on the metal

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be used over a portion of the object leaving exposed highlights, etc., which may be plated. In the latter case, the plating may be done either before or after the enamel has been applied. In these cases a stop-off lacquer is required and in case the plating is done after the enamel is applied, the enamel must withstand the plating operation.

Spatter finishes may be used to obtain a variety of patterns of contrasting colors. The object may be coated over all with a solid covering color usually by spray application and then followed by spattering the lighter color in any design with a spray gun regulated to give the particular pattern.

The pearl essence finishes are likewise applied over a solid covering coat of enamel and then are protected by clear top coats as desired. Many attractive finishes may thus be developed and the casket industry has utilized this system to advantage. A combination of shaded finishes with the pearl coating make very attractive systems.

These suggestions for adding beauty and satisfactory protection to base metal products with the conservation of plating materials are the basic contributions of the coating industry to the metal finishing industry. The relation of the raw material used in the manufacture of coating materials to the needs of vital industries and direct war products as well as a knowledge of the source of some materials will show the dire need for rationing and allocation of these ingredients. It will also show why the quality of some finishes must be sacrificed in order to aid the all-out war effort. The suggestions given herein may change momentarily but seem worthy of consideration.

Patents

Adhesive Lacquers

U. S. Pat. 2,268,651 J. Eggert & B. Wendt & A. Jung (Germany), assignors by mesne assignments to General Aniline & Film Corp., Jan. 6, 1942. An adhesive lacquer comprising an organic solution of a cellulosic film-forming substance, a resinous elastic plastic polyvinyl ester and a substance which is at least swellable in water and soluble in organic solvents, selected from the class consisting of mixed polymers

of polyvinyl esters and maleic acid anhydride and mixed polymers of polyvinyl ethers and maleic acid anhydride.

Corrosion Prevention of Magnesium

U. S. Pat. 2,268,331 E. G. Crooks, Dec. 30, 1941. A method of producing a non-smudging, adherent coating on a magnesium surface, which comprises treating said surface in a hot aqueous solution containing an alkali metal borate and an alkali metal bicarbonate capable of providing available carbon dioxide in the coating solution.

Example: Alkali metal

bicarbonate	4-12% by weight
Borax	1-8% by weight

Time: 5-45 min.

Temp.: 200-212° F.

Spray Gun

U. S. Pat. 2,277,928 W. F. McKee, assignor to C. M. Hardy, March 31, 1942. A spray gun of novel construction and design.

Surface Coating

U. S. Pat. 2,279,754 W. Krumbhaar, Apr. 14, 1942. A surface coating composition adapted to give a porcelain-like, non-porous and tack-free surface containing at least 50% of a soft drying oil selected from the group consisting of linseed, perilla, soya bean and sunflower oils in the non-volatile portion thereof, and a soap selected from the alkali earth metals, magnesium and manganese soaps of oleic and linoleic acids, in an amount more than 1% based on the amount of the soft oil but insufficient to produce deep longitudinal folds in the dried coating.

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Solvents In Industry

Turpentine

(*Gum spirits of turpentine, gum spirits, gum turpentine, spirits of turpentine, oil of turpentine, steam distilled wood turpentine, wood turpentine, steam distilled turpentine, destructively distilled wood turpentine, sulphate wood turpentine, sulphate turpentine*)

Turpentine is a volatile oil of natural origin consisting mainly of terpene hydrocarbons. Commercial grades vary in color from water white to pale amber and possess a not unpleasant aromatic odor which has come to be associated with architectural paints. Because turpentine is a natural rather than a synthetic product, its physical characteristics are subject to some variation depending in part on the method of manufacture, etc.

The specific gravity of turpentine is listed as ranging from 0.857 to 0.868 at 20°C. (7.13 to 7.22 pounds per gallon). Its boiling range lies between 154° and 201°C. (309-394°F.) and its evaporation rate varies from about that of commercial methyl amyl acetate to that of commercial mixed isomer amyl alcohol. Using the method prescribed by the American Society for Testing Materials, its flash point is from 110° to 115°F. Its auto ignition temperature is approximately 475°F.

Turpentine is soluble in a wide variety of organic fluids including chlorinated hydrocarbons, carbon disulphide, ether and other solvents. Unlike many organic solvents employed in organic finishing materials, it is only slightly soluble in water and water is insoluble in it. It is a good solvent for many different substances including waxes, resins, rubber (caoutchouc), fats, oils, etc. A list of the solubility of various substances in turpentine is given below:

Batavia Damar	Soluble, cloudy
Congo	Insoluble
Congo (run)	Soluble
Ester Gum	Soluble
Gutta Percha	Partially soluble
Kauri	Insoluble
Kauri (run)	Soluble
Linseed Oil	Soluble
Manila Copal	Insoluble
Mastic	Insoluble
Paraffin	Soluble
Pine Oil	Soluble
Pontianak	Insoluble
Rosin Oil	Soluble

Manufacture

The first and still most important method of producing turpentine is by distilling the oleoresinous exudate of living pine trees, particularly the longleaf pine (*Pinus palustris*, Miller) and the slash pine (*Pinus caribaea*, Morelet) found in the southern part of the United States. During the months of April to October, the trees are subjected to a series of V-shaped cuts into the inner bark. The gum which flows from these cuts is caught in small cups placed at the bottom of the cut, is periodically collected and sent to the still

where the turpentine is separated from the other constituents of the gum by simple distillation. The turpentine thus obtained is properly known as gum spirits of turpentine and constitutes about sixty five per cent of the turpentine produced annually in the United States.

There are also three other methods for producing turpentine, namely, by steam distillation, by destructive distillation, and from the process which makes sulphate wood pulp. These methods differ from that by which gum spirits of turpentine is made in that dead gum bearing wood is processed rather than the gum from the living tree. The turpentine from these three processes is referred to as steam distilled turpentine, destructively distilled turpentine, and sulphate wood turpentine, respectively.

In the steam distillation process, stumps, etc. are finely ground and placed in a digester into which live steam is passed. The steam carries out the volatile constituents of the gum in the wood. The volatile matter and water vapor are condensed and the turpentine is separated by distillation.

Destructive distillation also employs stumps, branches, etc. The wood is placed in air tight retorts which are strongly heated. The volatile constituents in the gum of the wood are vaporized, led from the retort to condensers and finally separated into various products including turpentine.

In the sulphate wood process, turpentine is obtained by condensing the vapors from the digesters in which pine wood is made into pulp for paper. This turpentine is processed by chemical treatment and fractional distillation to remove contaminating sulphur compounds.

Uses

Turpentine finds its chief use as a solvent and thinner in the manufacture and application of organic finishing materials of various kinds including paints, enamels, lacquers, varnishes, wood stains and fillers, etc. There are, however, numerous other important applications for turpentine in industry, in science and in medicine. It is used as a

Specifications

The following lists the specifications of one grade of steam distilled wood turpentine.

	Maximum	Minimum	Typical Analysis
Specific Gravity (15.5/15.5°C.)	0.865	0.860	0.861
Refractive Index (20°C.)	1.470	1.465	1.466
Unpolymerized Residue (38N-H ₂ SO ₄)	2.0%	—	0.8%
A.S.T.M. Distillation			
Initial Boiling Point	160°C.	150°C.	154°C.
95% at	170°C.	—	164°C.
Color	—	—	clear, colorless
Odor	—	—	mild, flat
Flash Point (Tag Open Cup)	—	—	98°F.
Optical Rotation	—	—	above +25
Kauri Butanol Number	—	—	approx. 57
Government Regulations: None.	—	—	—
Shipping Regulations: Does not require red caution label.	—	—	—

solvent, chemical raw material, pharmaceutical, etc.

Turpentine is used in the compounding of paste shoe polishes as well as stove door, furniture, automobile, linoleum, metal and jewelry polishes; in the manufacture of sealing, modelling and grafting waxes and drawing crayons; in the preparation of such chemicals as terpineol, terpin hydrate, essential oils, synthetic resins and various terpene polymers; in the manufacture of laundry glosses and washing preparations, anti-trotting agents, insecticides, disinfectants, rubber softeners, textile printing compounds, water-proof cements, etc.

Many salves, medicated soaps, liniments and other pharmaceutical preparations employ turpentine. In this connection, turpentine for use for medicinal purposes must comply with the requirements of the United States Pharmacopeia.

Turpentine also finds use in the bleaching of animal bones, in the ceramic arts, in lithography and in the drilling and grinding of glass.

Chemical Properties

The principal constituent of turpentine is pinene, a cyclic terpene having a boiling point of 156°C. (280.8°F.). Also there may be varying amounts of dipentene, and such compounds as paramenthane, fenchene, camphene, cymene, terpinolene and terpinene.

Some of the chemical reactions of the constituents of turpentine are as follows:

Pinene combines with one molecule of hydrogen chloride to yield pinene hydrochloride, a crystalline solid. This pinene hydrochloride, being unstable, immediately goes over into bornyl and isobornyl chlorides by an intramolecular rearrangement. The mixture of bornyl chloride and isobornyl chloride is often called artificial camphor since it resembles camphor in odor and appearance.

When pinene and dipentene are allowed to stand with dilute mineral acids, terpin hydrate is formed.

A few drops of turpentine on absorbent paper will blaze in chlorine gas, giving hydrogen chloride and a large cloud of finely divided carbon (soot). The reaction may be stated thus:



For checking the specifications of turpentine reference may be made to the Federal Specification for Turpentine for paint, LLL-T-791B, and the A.S.T.M. Standard Specification D 13-34 for turpentine.



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The Stabilization of Chlorinated Solvents for Metal Degreasing

By C. F. DINLEY*

IN the cleaning or degreasing of metals by the use of hot solvents, excellent results are being obtained. This covers all metal industries and all metals. It would be safe to say today that any plant which is set up to fabricate metal—ferrous or non-ferrous—is conversant with or has a hot metal-degreasing system.

The only safety solvents suitable for hot metal-degreasing are the chlorinated solvents. This method of cleaning takes advantage of their high vapor weight, low specific heat, and non-inflammability. While not a panacea for all metal cleaning, solvent degreasing is one of the most important advances made in the cleaning of metals in the past twenty years.

In metal degreasing with chlorinated solvents, the metal leaves the degreaser entirely free from liquid. The hot dry metal may be stored or processed immediately as there are no stains and no discoloration, the metal being immediately ready for inspection, painting, and in many cases plating. The degreasing equipment requires a minimum of space, heat, and water.

In the early stages of metal degreasing, the design of a suitable apparatus that was open at the top or ends to permit the entrance and exit of the work took up most of the development.

The Need for Stabilization

When the writer's laboratory tests on the various chlorinated solvents under consideration for metal cleaning were well along, the rather startling fact was revealed that these solvents had a tendency to split up into other chlorine products, amongst which was hydrochloric acid. This fact indicated that research was needed to prevent such occurrence, as the metal degreasing process would be of

Developments in the theory and practice of stabilization of chlorinated solvents, especially for the metal cleaning industry, are discussed by the author, who pioneered in this field. His researches were awarded with the original basic stabilization patents, as well as many subsequent ones.

no commercial value until this difficulty was overcome.

In manufacturing the degreasing apparatus, commercial steel sheets, plates and shapes were to be used, as this type of steel is readily available and the original cost is low. However, in the presence of even a trace of hydrochloric acid, the application of steel or other commercially economical material would be precluded. The action of hydrochloric acid on ordinary metal results in the solution of the metal with the formation of a chloride of the metal dissolved. The effect of some metallic chlorides on the chlorinated solvent is catalytic, which results in a rapid decomposition of the solvent with liberation of heat, and the formation of gaseous hydrochloric acid in large and copious amounts. The deposition of carbon and other products also resulted from the decomposition of the solvent.

The effect on the degreaser itself was to completely dissolve the steel sheets of which it was made, particularly at the liquid level. Complete disintegration of steel sheets 3/16 in. in thickness was not unusual. Furthermore, the gaseous hydrochloric acid vapors liberated by this decomposition escaped from the machine and circulated through the room. These acid vapors affected all metal parts within a radius of 200 ft., causing discoloration and corrosion.

The decomposition of the solvent was caused by light, water, heat and some non-ferrous metals, as well as, by fatty acids, etc. A search of liter-

ature, text books, and other printed matter brought to light that this problem of decomposition had been completely ignored.

Research was immediately started along various indicated lines. Fractions of the commercial chlorinated solvents were brought to closer boiling ranges, but this did not help. Original containers were imported direct from foreign countries, but on the whole these were consistently of poorer quality than the same solvent made in the United States.

After these facts were brought to light, work on the problem of stabilization began in earnest. Additive chemicals, such as those that were easily chlorinated, were first employed, the thought being that under the heat of the degreasing process the easily chlorinated material would prevent the formation of hydrochloric acid. Any objectionable substances formed would be removed in the process of solvent purification, that is, distillation which is a routine procedure in the maintenance of degreasers. This line of endeavor proved of little value.

Lime and soda ash were next tried as a means to immediately neutralize any hydrochloric acid formed, but again this proved worthless. These materials were in the nature of a corrective, rather than a preventive measure, and were only effective in the presence of moisture, which in itself was deleterious.

Stabilization Theory

The final theory of incipiently absorbing any acidic products of decomposition by a substance capable of assimilating the hydrochloric acid

*Vice-President in Charge of Engineering, Manufacturing and Research of Detroit Rex Products Company, Detroit, Michigan.

in its entirety without the end products themselves being harmful, was tried. This proved to be the correct theory for stabilization.

Organic chemicals capable of this reaction cover many fields, and experiments were legion. Among the groups tried were organic bases—all types and kinds. The solvent soluble bases gave the consistently best results when added directly to the solvent. It was then noted that the mother liquid would remain stable, but that the vapors were neutral when distilled. This condensate soon showed the same degree of cleavage as the original solvent. This was true to a varying degree for all chlorinated solvents under simulated metal degreasing trials.

The results of these experiments indicated the necessity in the metal degreasing field of having a stabilizer of the organic base type,** which would be soluble in the chlorinated solvent, would volatize with the solvent vapor during distillation, remain soluble in the vapor and condense with the vapor, thus rendering the condensate stable. This is successfully accomplished by using an organic base whose boiling point and vaporizing rate is such that the reaction of the chlorinated solvent is always basic regardless of the number of times the solvent undergoes distillation.

The degreaser is to all intent and purpose a thermo-balanced, open still, wherein a heating means is placed at the bottom of the vessel. Application of heat allows the vapor to rise to a predetermined height. This vapor height is controlled by placing a cooling means within and attached to the open tank at a definite level below the open top. Thus, we have the vapor rising and the vapor condensing in the open vessel. By means of a trough or gutter, the liquid solvent is collected and the stream can be directed as desired.

As the degreaser has an open top, see Fig. 1, the solvent vapor is always in contact with air. This air is constantly in motion and contains moisture which is transferred to the solvent vapors at the interfacial layer. This exchange actually is a source of introduction of moisture, which amount, in addition to that accumulated from the metal being cleaned in a commercial degreaser, at times may become considerable. Therefore, a water separator is supplied with most

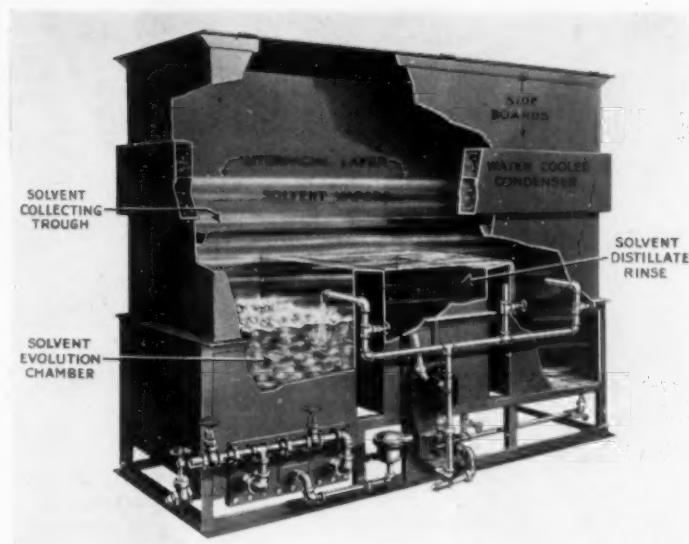


Figure 1. Cut-away view of a three-dip, hand-operated, immersion type degreaser arranged for steam heating. Note relative position of condenser, vapor layer, and side boards above vapor zone.

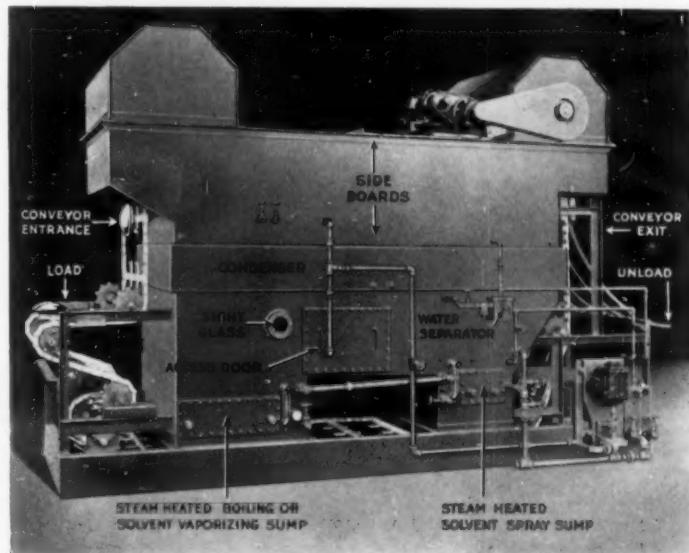


Figure 2. Conveyorized degreaser open at both ends. Water separator is located in distillate return line from solvent collecting trough.

degreasers. See Fig. 2. It is this moisture which saturates the solvent vapors at the time of condensation that make it necessary that the solvent vapors be slightly basic. At this condensation stage, in contact with metal and under the influence of daylight, the chlorinated solvents are very easily decomposed.

The same theory of stabilization is applicable to all types of chlorinated solvents, and gives considerable freedom in the kind of organic base used. Therefore, proper consideration may be given to the use for which the solvent is stabilized, namely, when chlor-

inated solvent is to be used for food extraction or the cleaning of clothes, the amount and kind of stabilizer may be varied to meet the exact requirement imposed by this specific application.

This flexibility renders stabilization practical, easily controlled, and positive in action.

^{**}The following U. S. Patent numbers cover the stabilization of chlorinated hydrocarbon solvents, and equipment for their use in industrial cleaning applications: 1,771,698; 1,869,826; 1,869,845; 1,875,937; 1,907,875; 1,911,926; 1,938,841; 1,942,355; 1,961,867; 1,984,364; 1,987,586; 2,016,376; 2,018,648; 2,020,335; 2,028,759; 2,036,261; 2,101,840; 2,101,841; 2,107,369; 2,113,129; 2,116,862; 2,116,863; 2,137,479; 2,214,788; 2,223,595; 2,273,939; RE-20,359.

NEW EQUIPMENT AND SUPPLIES

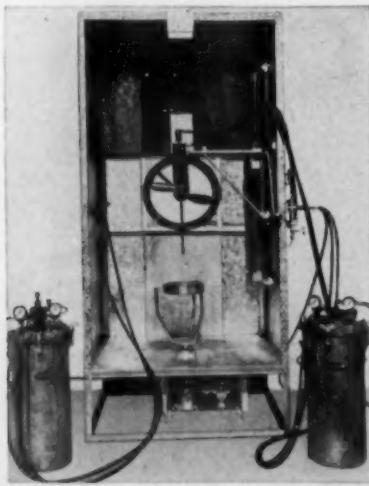
LATEST COMMERCIAL DEVELOPMENTS IN ORGANIC FINISHING

Finish for Shell Interiors

Zapon Division, Atlas Powder Company, have recently perfected for the Army, a new straight phenol-formaldehyde finish, to coat the interior lining of the new steel shell cases which are now authorized by the Government to conserve critical brass. Known as S-198-C in the Zapon series, the new Zapon finish protects the inside walls of the new type shell cases against conditions of use or corrosion caused by the action of powder, rust or other agents. Zapon laboratories worked with the Army from the inception of the project and the company is gratified that this finish more than fulfilled the rigid military requirements. Only a formulation of the most exacting standards will meet the exacting specifications required.

Shell Sprayer

A special unit for spray coating 8" shells in a vertical position has been built by the Eclipse Air Brush Company, 400 Park Avenue, Newark, N. J. The inside coating is done with a semi-automatic spray gun fitted with a long extension nozzle. The outside is sprayed manually by the same

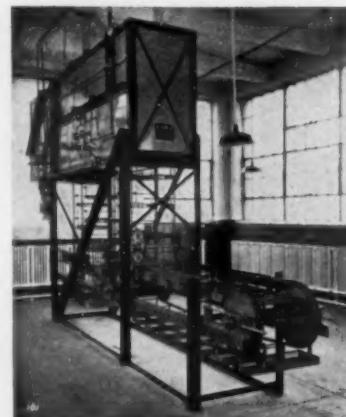


Unit for spray coating of 8" shells.

operator who handles the inside coating operation. The shell is rotated by an air motored tripod with a ring at the top to protect the driving band from paint. The rate of production by this method of operation is approximately 25 pieces an hour.

Bomb Fuse Dipping and Drying Oven

The Lanly Co., Cleveland, Ohio, are here-with showing a typical example of the company's heat treating and drying machinery.



Continuous basket type conveyor oven for lacquering and drying of bomb fuses.

The equipment shown is a continuous, gas-fired fuse dipping and drying oven.

Bomb fuses are placed in baskets which are hung on the conveyor. The baskets then move upward to a pre-heating zone, downward into a dip tank, through shaker to remove excess lacquer, upward into drying zone, in which it moves backward, forward and then down to the unloading position. The fuses are pre-heated six minutes at 180°, and baked for fifteen minutes at 212° F.

The overall size of the unit is 3' x 20' x 11' high and is gas-fired.

New Formula Increases Importance of Tung Oil Substitute To War Effort

Adaptation of the new tung oil substitute "Kellin" will facilitate the continued manufacture and use of wrinkle finishes for commercial and war purposes.

Fears that fast dwindling stocks of tung oil—the hard drying and wrinkling ingredient used in Wrinkle finish—would soon force a serious reduction in the production of these standard varnishes and enamels have now been alleviated.

The adaptation of "Kellin" by New Wrinkle, Inc., Dayton, Ohio, now makes it both feasible and economically possible for the first time to produce a satisfactory commercial Wrinkle finish from a linseed oil base. This new formulation was developed and tested within two weeks following announcement in the Wall Street Journal of "Kellin" by Spencer Kellogg & Sons, and in the face of years of varnish manufacturing practice and a general opinion in the paint industry that linseed oil was inferior to tung oil as a base for Wrinkle finish. The new formula was developed by William A.

Waldie, Technical Director, New Wrinkle, Inc., in its laboratory at Dayton, Ohio.

The use of "Kellin" for the production of Wrinkle finish is particularly significant at this time because Wrinkle is specified as standard for many pieces of war equipment, practically all instruments being so finished, for example. It will thus result in the release to other purposes of thousands of gallons of tung oil, a critical material now that importations from the Far East have been discontinued. Its new "Kellin"-Wrinkle formula has been announced by New Wrinkle, Inc., to all its more than 160 manufacturing licensees.

Corrosion Inhibitor for Lacquers

A corrosion-inhibiting additive for clear lacquers, nitrocellulose solutions, and alcoholic shellacs which eliminates the need for shipping these materials in tin-lined drums, has been announced by the Merrimac Division of Monsanto Chemical Company, Boston, Mass.

The additive is a solution of an organophosphorus compound and is known as D.P. Solution. Used in lacquers in proportions of 0.1 to 1.0 per cent, it has been found to give effective protection against corrosion of iron or steel under conditions met in the handling of lacquer shipments.

Its action is ascribed to the fact that it reacts with iron to form an insoluble film. Though of but microscopic thickness, this film is sufficient to afford protection to the surface and in case of breaks it is self-mending by virtue of the very manner in which it is formed.

It is expected that the use of D.P. Solution will continue after the current tin shortage because it offers a cost advantage over tin-lining of drums even at pre-shortage prices. Two pounds of tin ordinarily are required to coat the interior of a single 55-gallon drum of the type used for industrial shipments of lacquers.

In addition to inhibiting corrosion, D.P. Solution has demonstrated, according to the manufacturer, interesting properties as a flocculating agent for maintaining good suspensions of the flattening agent in flat lacquers. The majority of lacquers contain sufficient flocculating agent introduced through the solvents, nitrocellulose or flattening agent itself, to prevent settling, but it has been found that this condition is assured in almost any lacquer when D.P. Solution is used.

Relative to the problem of lacquer corrosion, Dr. G. R. Barrett, responsible for the development, says the following:

"The tendency for water-white lacquer solutions and nitrocellulose solutions to discolor on standing in steel containers is

well-known. This discoloration is due to the formation of colored iron salts caused by the attack on the steel drum of acids developed by the hydrolysis of the solvents used.

"As it is impractical always to use anhydrous solvents, the common way of overcoming this difficulty has been to ship or store materials in tin-lined drums. These drums are costly and furthermore at the present time tin is not easy to secure. The addition of D.P. Solution to the lacquer or nitrocellulose solution seems effectively to prevent corrosion and consequent discoloration when storage is in ordinary steel. The small percentage required has a negligible effect on other properties of the lacquers.

The minimum amount of active constituent should be not less than 0.75 per cent on the weight of the nitrocellulose. The amount required depends upon the corrosive tendencies of the lacquer and the concentration of nitrocellulose. In general, lacquers containing acid resins require more than when neutral resins are used. Highly concentrated solutions of low viscosity nitrocellulose require more additive than dilute solutions or solutions of higher viscosity nitrocellulose. Most corrosion starts at the liquid vapor line and once started progresses rapidly. It is advisable where drums are used for storage to invert them for a short time before leaving them in a given position for a long time. This permits a coating to form over the entire interior of the container.

"D.P. Solution has been thoroughly tested in practice. Lacquers containing it have been shipped from Boston through the Panama Canal to the Pacific Coast without any corrosion taking place despite rapid changes in weather encountered on the voyage and long exposure to high temperatures. Shipments have also been made to China and have arrived in satisfactory condition."

Mr. John J. Healy, Jr., director of development, Merrimac Division, stated further that D.P. Solution is not recommended for pigmented lacquers inasmuch as pigments absorb it from solution and render it ineffective. Neither is it recommended for use in paints or synthetics which dry by oxidation, as it will precipitate the driers.

New Temporary Coating Is Transparent

To reduce rejects due to rust, surface scratches, shop wearing, grease and dirt, a new protective coating for metal and ceramic surfaces is announced by Ault & Wiborg Corporation, Cincinnati, Ohio.

Known as "Protekto Stripping Lacquer," the material is said to be unique in that it is completely transparent to permit visual inspection of the coated parts. The plastic base coating is particularly applicable to highly polished surfaces such as flat sheets, molds, irregular shapes, dies and bearings—offering protection during handling, fabrication, shipping, storage and installation.

In application, the liquid is sprayed, brushed, dipped or roller coated; then air dried to leave a flexible glass-clear coating of from 0.001" to 0.0015". One gallon, when sprayed to a thickness of one mil,

will cover approximately 250 square feet of surface. Drying time at 200° F. is six to eight minutes.

To remove the coating, it is necessary merely to lift one edge with the fingernail and peel, or blow off with an air jet. The degree of adhesion to the part protected is controlled to eliminate the possibility of accidental or premature removal. Water and sun-proof, the coating is not affected by most greases and oils. There is no deterioration or cracking at temperatures between zero and 200 degrees Fahrenheit. It is also available in colors, making an ideal temporary identification medium.

Spray Booth Coating

The Detergent Department of The J. B. Ford Sales Company, Wyandotte, Mich., has recently developed a new use for "Wyandotte Detergent" which has been used for so many years as a general maintenance cleaner in hospitals, office buildings, hotels, institutions, etc.

Today as many people know, most of the painting of furniture and equipment, etc. is done in what is known as a spray booth. The old method of covering the inside of these spray booths was by using soap, oils, or heavy greases and in some cases old wrapping paper greased to hold it in place. This method, as can be readily seen, does not lessen the fire hazard which is usually present in any spray booth.

The J. B. Ford Sales Company has found that by mixing their Detergent and water to about the consistency of a good thick paint, it can be brushed on the sides and even the ceiling of a spray booth or even applied with a spray gun. As this dries it leaves a thin coating all around the inside of the spray booth to which the paint or lacquer adheres. When they are ready to clean the inside of this spray booth at night, or twice a week, or even once a week, the whole coating peels right off—and as one of their customers recently expressed it, "We can clean a spray booth the size of 8' x 8' x 20' in about thirty minutes making it as clean as it was the day it was installed."



Workman applying spray booth coating.

This coating operation with Wyandotte Detergent is claimed to be very helpful because it not only saves time of the operator which is important nowadays, but it materially reduces the fire hazard as well. This product has just been approved by "Associated Factory Mutual Fire Insurance Companies."

Manufacturers' Literature

Airplane Finishes

"Wings of Victory" is the title of an illustrated booklet recently published by *Berry Brothers, Inc.*, Detroit, Mich. Text and many photographs show various phases of our aviation program including training, description of American and Allied planes, as well as enemy planes, and photographs of insignia. The booklet contains many remarkably beautiful photographs in color of various types of aircraft, to which have been applied various Berry primers and finish coats.

Copies are available to all readers who may desire them.

Chemical Driers

McGean Chemical Co., Cleveland, Ohio, have published a price list entitled "A Complete Line of Chemical Driers", listing products of this type made by the company. Included are naphthenates, metal salts, linoleates, cobalt pastes, fused resins and precipitated resins.

Revised Brochure on Infra-Red Issued

"New Facts About Infra-Red," a revised brochure just issued by the *Ault & Wiborg Corporation*, is now available to manufacturers who want information on the use of infra-red to bake industrial finishes.

This booklet contains the latest available data on the use of infra-red, with particular emphasis on the speeding up of war industry. According to the brochure the finish on such important items as armor plate, shell cases, machine tools, and motor parts is baked dry by infra-red in a few minutes. Space formerly used for drying racks is now utilized for actual production.

"New Facts About Infra-Red" also contains answers to questions commonly asked about infra-red methods. There are photographs of various types of infra-red installations, including war production applications. Copies of this booklet may be obtained by writing to *Ault & Wiborg Corporation*, 75 Varick St., New York City.

Spray Finishing Equipment

Binks Mfg. Co., 3114 Carroll Ave., Chicago, Ill., have issued their new catalog No. 80 describing almost all types of equipment required for spray painting and finishing. Considerable treatment is given to the equipment required in war production work, such as paint circulating systems, spray booths and automatic equipment for finishing of specific products, such as bombs and shells. Views of many large installations are included in the book. A copy of this catalog will be mailed on application to anyone interested, written on company letterhead.

Spray Painting

In a profusely illustrated 15-page booklet, "How to Speed Up Your Finishing Operations," the technical staff of the Finishes

Division, *E. I. du Pont de Nemours & Company*, explains the 11 factors that must be properly controlled in order to attain the utmost efficiency in spray painting.

Because today, manufacturers are confronted with new finishing problems as a result of conversion, and many semi-experienced spray-gun operators work on the production lines, the pocket-size booklet is expressly devised as an educational piece to help speed output, avoid rejects and wasted finishing materials.

The 11 points for efficiency and conservation described in text and illustrated by photographs and diagrams are: Temperature of Paint; Air and Fluid Pressures; Viscosity of Paint; Adjustment of Spray Gun; Handling of Spray Gun; Triggering of the Gun; System in the Strokes; Uniformity of Coating; Thickness of Film; Causes of Rejects; Touch-Up Procedure.

Production engineers, finishing foremen and others interested in spray-gun operations may obtain copies by writing to the Du Pont Finishes Division, Wilmington, Del.

Business Items

General Printing Ink Corp. Forms General Industrial Finishes Division

The General Printing Ink Corp., 100 Sixth Ave., New York City, have pooled the facilities of the entire corporation into one division called "General Industrial Finishes Division," for the manufacture of industrial finishes and other protective coatings. John F. Devine, vice-president of the corporation and general manager of the Fuchs & Lang Mfg. Co. Division, will also act as general manager of the new division. Walter A. McKim, previously director of Industrial Research for the Pittsburgh Plate Glass Co. will be assistant general manager. The new division will formulate and manufacture a large variety of products, such as primers, finished goods and special finishes for various war goods, such as bombers, gun mounts and ammunition containers. In addition, other finishes, vital to general use, will be made.

Herschel E. Post has been appointed general sales manager, industrial finishes, Pittsburgh Plate Glass Company, with headquarters at Pittsburgh, E. D. Griffin, vice president, announced. Mr. Post previously was manager of the Company's Houston, Texas, paint factory.

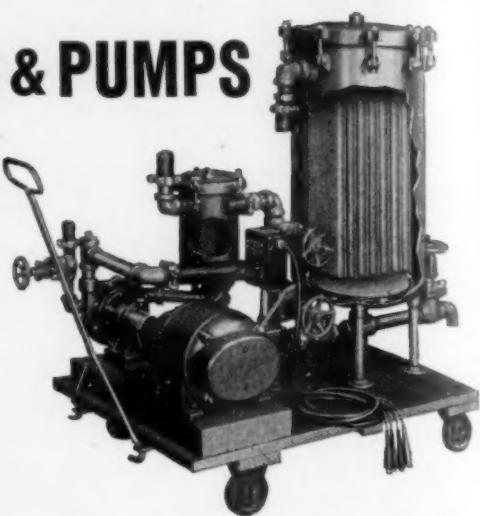
Mr. Post was born at San Francisco, Calif., and later moved to Sacramento. Between 1914 and 1917 he was engaged in business in Sacramento. In 1917 he enlisted in the United States Navy. Following the war he and his brother established an independent retail paint outlet that became a part of the Pittsburgh Plate Glass Company in 1930. In 1932 Mr. Post was named manager of the Oakland, Calif., warehouse, and in 1933, district manager in charge of the Oakland district. In 1940 he was placed in charge of the Houston plant.

John A. Hanley, production manager, temporarily will manage the Houston plant.

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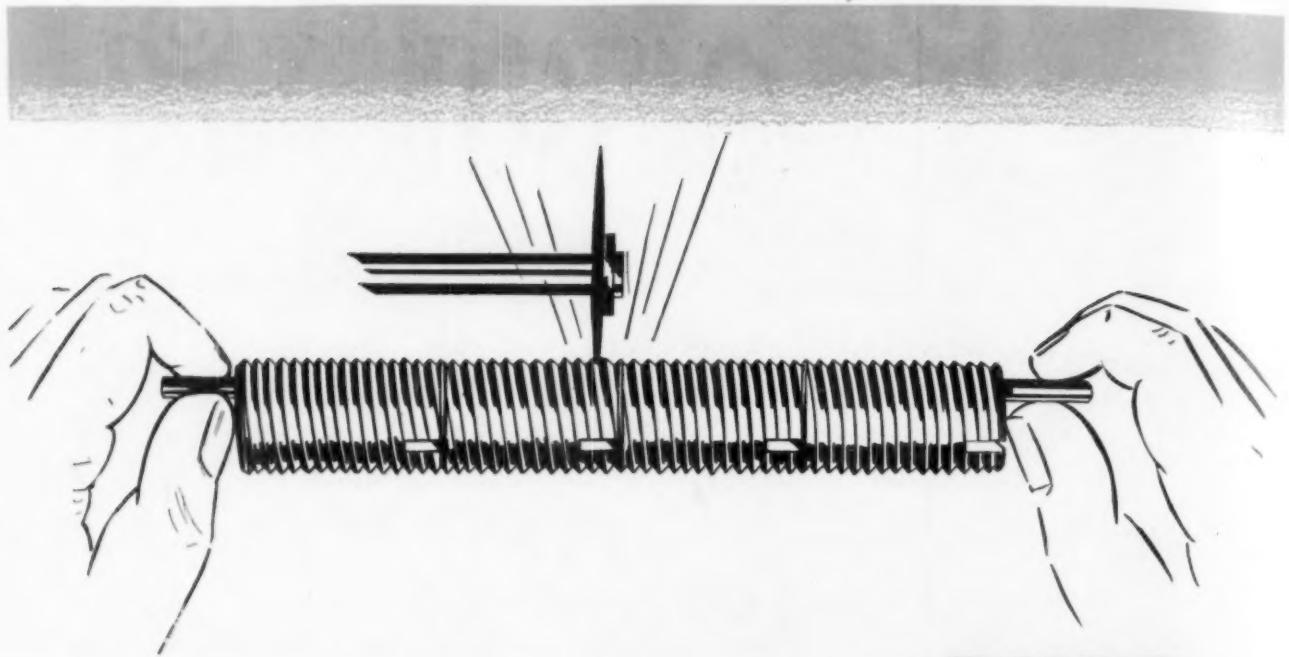
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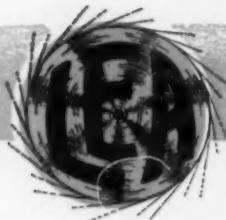
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VOL. 40, NO. 9

METAL FINISHING

PREPARATION, ELECTROPLATING, COATING

SEPT. 1942



William J. R. Kennedy

THE electroplating industry lost a highly respected member early Friday morning, August 7th, when William J. R. Kennedy passed away. He had long suffered from hypertension and in spite of his efforts to adjust his living to his critical condition, a cerebral hemorrhage severed the thread of life of one whose service to his work and fellow men warranted more than 56 years of life.

Mr. Kennedy was born in Northern Ireland, the son of a minister, and he went to Springfield, Mass., in the early 1900's. His first job at plating was with the American Electric Switch Company doing copper plating. About 1909, he became foreman plater for one of the divisions of the Westinghouse Electric and Manufacturing Company, newly moved to Springfield, and he remained with Westinghouse until he became Executive Secretary of the American Electroplaters' Society.

Mr. Kennedy's service to the A. E. S. was long, faithful and successful. He was elected National Second Vice-President in 1929 at Detroit, Mich. and at Washington, D. C. the following year, he was elected Editor of the *Monthly Review*, official publication of the Society. In 1936, the Society decided to have a full-time Executive Secretary and Mr. Kennedy was chosen for this position which he held until his death.

Bill, as he was affectionately called by all who knew him, in addition to being a persevering and capable workman, was ever helpful to his neighbors and associates. He was always ready to give advice to newcomers in plating or help the old-timers. He was a faithful churchman, being Deacon in the Carew St. Baptist Church of Springfield, and was a member of the Belcher Lodge of Masons.

He leaves his widow, Agnes (Stephenson) Kennedy; three daughters, Mrs. George Juke of Feeding Hills, Mrs. Albert Collings, Jr. of Springfield and Miss Beulah Kennedy.

George Hogaboom, one of the many electroplaters to pay tribute to Mr. Kennedy at his funeral, expressed the feelings of all when he said, "Bill was a most kindly spirit. He was ever ready to conciliate differences in policy. He was a staunch defender of research and had good ability to get along with people. He contributed, in a large measure, to the success of the American Electroplaters' Society."

A Silver Famine in the Midst of Plenty

The Government silver policy has always been puzzling to most people and the silver situation at present needs rectification more than it ever did. About 10 years ago, selfish pressure groups succeeded in having Congress pass a Silver Act bestowing "special privilege" on the American silver producers. The law requires that the U. S. Treasury must offer a price of 71.11c an ounce for all silver domestically produced.

Inasmuch as this price was more than double the price of imported silver, there were obviously no purchasers for domestically produced silver other than the United States Government.

Another clause in the Silver Act makes the selling of silver purchased by the Treasury almost impossible, because the Treasury is forbidden to sell silver at less than \$1.29 an ounce which is nearly four times the former market price of silver.

Since December 1933, 2,600,000,000 ounces of silver have been added to our stores and at the present time, the total stock of silver is 3,330,000,000 ounces, which is about five times the amount of silver owned by our Government in December, 1933. Of this amount of silver, 806,000,000 ounces are in the form of coins and 1,164,000,000 ounces are allocated to our silver certificates. This leaves over 1,300,000,000 ounces unallocated.

It should be emphasized that the Treasury is not responsible for these accumulations of silver but is merely carrying out the principles of the law passed by Congress and it is up to Congress to repeal or modify the Silver Act to enable proper use to be made of the tremendous stores of silver available. In view of the fact that the silver certificates, or paper money, are backed by silver, it is not possible to distribute 1,164,000,000 ounces of silver for actual consumption, such as using silver for plating or making alloys.

The Treasury, last April, started a so-called "lend-lease" silver plan which provides for the loan of silver to the Defense Plant Corporation with very strict limitations. The silver must not become a part of the products produced in war production plants or must not be used up. It can only be used in such form that it can be returned to the Treasury after the war. Therefore, the use of lend-lease silver has been largely as a substitute for copper in the making of bus bars. Up to the present time, only about eight per cent of the 1,350,000,000 ounces of free

silver have been made available. It is the opinion of many that the silver backing up the silver certificates, or paper money, could be used for lend-lease purchases maintaining the present restrictions and there would therefore be almost 1,400,000,000 ounces of silver available for actual consumption by war and civilian industries. Many economists believe, further, that all of the silver could be used or consumed by industry in view of the tremendous gold holdings of the Government to back up the paper money.

The use of foreign silver by the silver working industry and by electroplating comes under Conservation Order M-199 which, after October 1st, 1942, restricts the use of foreign silver only to products or parts bearing preference ratings of A-3 or higher. Only foreign silver is mentioned in the conservation order because all of the domestically produced silver is being purchased by the Treasury to store it in vaults and thus remove it from industrial use.

If the present silver policy is continued, many silver working industries will be forced out of business, and in fact, many have gone out of business already. Retail jewelers are suffering from a scarcity of silver or silver-coated merchandise and many of these will be faced with ruin inasmuch as almost fifty per cent of their business is done in articles made of silver.

The OPA recently raised the ceiling on foreign silver from thirty-five to forty-five cents an ounce. This was done at the request of the State Department largely to give the Mexican Government a subsidy of seven cents and the Mexican producer a subsidy of three cents per ounce. This was done in the hope that Mexican producers would increase their production as a result of the higher price. In keeping with the strict provisions of the Silver Act, the OPA fixed the ceiling price of the domestically produced silver at 71.11c an ounce, plus freight charges. This ceiling would, therefore, prevent anyone from offering a higher price for domestic silver than that offered by the Treasury.

The unfair provisions of the Silver Act should be immediately modified to enable industry to use the large stocks of silver held by the Government and also to utilize the large production of silver in this country.

There is an ample supply of silver for both war and civilian purposes and it is up to your congressman to see that the silver is made available to you.

Bright Copper Plating In Acid Baths[†]

BY F. L. CLIFTON & W. M. PHILLIPS

*Electrochemistry Dept., Research Laboratories,
General Motors Corp., Detroit, Mich.*

IN THE plating industry, the general use of bright nickel baths has done much to relieve the high cost of preparing electroplated deposits for the deposition of tarnish-resisting chromium. However, before bright nickel can be deposited there is still the problem of obtaining a satisfactory copper undercoat to receive the bright nickel. This polished copper surface has been obtained by depositing a layer of copper and then buffing. The buffing operation is often expensive and wasteful. The average pre-war automobile has approximately 45 square feet of highly finished surface which required 33.3 oz. of copper for each car for a deposit of 0.001", which was necessary to allow for a loss of 0.0003" or 10 oz. per car for buffing. This is a conservative estimate of the loss of copper by buffing because, although perhaps one-third of this 33.3 oz. of copper per car was deposited on unseen areas, we know that all too frequently the copper is entirely buffed through on significant areas. The compilation of these figures showing a loss of 1,250,000 lbs., or 625 tons, of copper on a year's production of 2,000,000 vehicles encouraged our laboratory to devise a means of eliminating most of this waste.

Thiourea as a Brightener

Our research in the laboratory for a suitable brightener for copper plating baths disclosed the fact that small additions of thiourea exerted a marked effect on copper deposited from an acid plating solution. A standard bath was decided on for laboratory experiments, which consisted of:

CuSO ₄	250 grams per liter
H ₂ SO ₄	10 " " "
Temperature	70-80° F

Further investigation of the effects of various concentrations of thiourea, copper sulphate, and sulphuric acid showed that, under certain conditions, a uniformly bright deposit could be obtained by controlling these variables and operating conditions. When these conditions were varied beyond the prescribed limits, the deposits were not satisfactory. A large number of organic and inorganic compounds were tested for their brightening effect in the "standard" bath, but none of them was superior to thiourea. Continued experiments indicated that thiourea could be controlled and bright copper deposits obtained without any other addition agent in the bath, but a secondary addition agent was found to be beneficial. This secondary addition agent we called a "range increaser". By a "range increaser" we mean a supplementary addition agent which, when used

in conjunction with thiourea, makes possible the deposition of a plate of uniform brightness over a wider range of current densities. This definition may also be extended to include those compounds which prevent pitting and streaking of the deposits.

Three types of compounds fall into this classification: (1) organic compounds, (2) commercial surface active materials, and (3) some inorganic salts.

Of the organic compounds we tested in the standard bath containing thiourea, the aromatic sulfonic acids were most effective in producing uniformly bright deposits without danger of streaking. Since compounds of this type are used as brighteners in some commercial bright nickel baths, it is probable that their action in the acid copper bath is that of a secondary or auxiliary brightener. Some compounds other than the sulfonic acids, e.g., phenol and its derivatives, were found to be slightly effective but their low solubility makes them unsuitable. A further restriction for an effective sulfonic acid is that it be simple rather than complex in structure. Substituted derivatives of aromatic sulfonates containing more than one ring are effective, but one containing only one ring with a single sulfonic group is best. The simpler compounds also have the added advantage of forming smaller amounts of undesirable precipitates and anode coatings. Introduction of chlorine or a methyl group on the ring has no harmful effect, but the presence of a second sulfonic group greatly decreases the activity. There are several organic compounds that fulfill the above conditions.

Commercial surface active agents were next investigated as range increasers. The Triton compounds[‡] appeared fairly satisfactory, and, when used in the standard bath with thiourea, a soft semi-bright deposit is obtained. Triton No. 720 is a salt of a sulfonated ether.

When inorganic compounds were tested in the bath by adding binary salts, the effect of only one new ion at a time was determined by using a salt of this ion and of an ion already present in the bath.

Small concentrations of chloride ions completely eliminated the thiourea brightness.

Sodium and magnesium ions were beneficial in producing a uniform bright plate but caused burned deposits at high current densities. The ammonium ion, when introduced in the form of ammonium sulfate, is markedly beneficial as an anti-pitting agent and does not increase burning.

[†] Presented at the 30th Annual Convention of the American Electroplaters' Society held June 8-19, 1942 at Grand Rapids, Mich.

[‡] Made by Rohm & Haas Co., Philadelphia, Pa.

Semi-Bright Bath

The semi-bright copper was released to the various divisions of General Motors Corporation, and a series of production tests were run to determine the most suitable conditions for production. Many imperfections in fabricated steel are covered by buffing deposited copper, and the soft semi-bright copper deposits were found to be ideal for this purpose.

The product of the semi-bright copper bath is uniform, though sometimes not sufficiently bright as an undercoat for bright nickel. The brightening or polishing operation is nearer a wipe than a buff. Buffing the semi-bright deposit on an automatic buffer was done with four wheels instead of six, as previously required. Much less wheel pressure is necessary and savings in buffing wheels, buffing compounds, and lowered reject costs are considerable. Previously, from one to four ten-thousandths of an inch were removed in buffing. This was wasted copper, and many parts were rejected because cutting through the deposit while buffing had occurred.

The composition of a typical bath for obtaining these soft deposits is as follows, although some of our divisions made variations compatible with their own conditions:

Copper sulfate, crystals.....	250	g./l.
Sulfuric acid	10	"
Triton No. 720	0.20	"
Thiourea	0.01	"
Temperature	70-80° F.	
Average current density	48	amp./sq.ft.

Cathode movement or movement of solution by air, or other means, is recommended in order to permit the use of higher current densities.

Control

We have been unable to obtain a method of analysis for the thiourea or Triton, but the control of the addition agents by inspection of the deposits has proved satisfactory and many thousands of gallons of solution have been operated with no other method of control. The addition agents do not interfere with the regular methods of analysis used for the control of copper sulfate plating baths, nor do they affect the current density normally used with the regular acid copper plating baths. Increasing the temperature of the bath from 80° F. to 100° F. will destroy most of the brightness of the deposits but will only very slightly affect the buffing qualities. At a temperature of 120° F., almost all of the effects of the addition agents are lost. The bath may be readily purified by filtration after adding a suitable filter aid; this filtration will remove a large part of the addition agents. Hydrogen peroxide will nullify the effect of excess amounts of thiourea without leaving harmful reaction products in the bath, but additions of hydrogen peroxide should only be made after experiments in a laboratory bath to determine the quantity which should be added to the production tanks.

Experiments showed that uniform mirror bright deposits could be obtained when the bath was cooled below room temperature. A reduction in temperature of only 10° F. greatly increased the uniformity of brightness and reduced the tendency of the plate to become pitted and striated. At the optimum temperature of 55° F., the deposits were always uniformly bright and the wetting agent, Triton 720, could be omitted without danger of striation. At

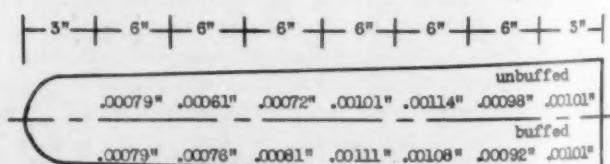
this temperature the only addition agent needed is thiourea at a concentration of 0.03-0.05 g./l. The conductivity of the bath decreases, but with sufficient agitation a current density of 48 amperes per square foot can still be used without burning or treeing. Another marked advantage of reduced temperatures is that the amount of thiourea that may be present in the bath is much less critical and may be used in larger amounts in a cold bath without danger of orange peel or striations.

The use of molasses in copper sulfate baths to obtain smoother deposits has long been known and one of our licensees found that the addition of thiourea to a bath containing molasses produced a brighter deposit than thiourea and Triton. This information arrived about the time when restrictions were placed upon the plating of automobile parts—requiring that buffing operations on decorative parts be drastically reduced in order to conserve metals. It was found that molasses decreased the tendency for striations in areas of low current density and does not decrease the brilliance of the deposits. Therefore, no buffing was required, and many baths, particularly those for plating bumper bars and guards, were immediately converted to brighter plating baths by the simple process of filtration with a suitable filter aid and then adding the required amounts of thiourea and molasses.

When using thiourea to obtain bright deposits, it is advisable to keep the temperature of the solution as near, or lower than, 70° F. as possible and apply the highest current density practical, which will of course decrease plating time. Vigorous agitation should be used which, contrary to some plating baths, will not cause rough work. There is undoubtedly a product of decomposition formed in the bath—the nature of this compound has not been determined—but, whatever the substance is, a point can be reached where sufficient is accumulated in the bath to destroy the brightening effect of the addition agents, and a further addition of thiourea will do no good. The bath must then be purified by filtration.

An 18,000 gallon bath has been operated with no attempt to obtain the highest luster of the deposits—the operators preferring to use a "wiping operation" on the bumper bars—and a graph (Graph 1) was made of a section of a bumper bar on which one-half was wiped. Measurements of the deposited copper by the "Magne-Gage" showed that the difference in thickness of the copper between the buffed and unbuffed areas is less than the variation in thickness due to difference in current density at various points on the bar during plating. A typical bath used in production contains:

Copper sulfate, crystal.....	210	g./l.
Sulfuric acid	30	"
Molasses	0.80	"
Thiourea	0.04	"
Temperature	70° F.	
Current density	70-75	amp./sq.ft.



Graph 1. Thicknesses of plate on buffed and unbuffed portions of bumper bar.

Not much variation in the copper sulfate has been used, but the other ingredients have been added over a fairly wide range and bright deposits produced at 20 amp. per square foot. The amount of thiourea required to maintain the brightest deposits has not been definitely determined, but it is known that well over 1000 ampere-hours of plating can be carried on without additions of thiourea. Due to the small amount of brightener used, it is suggested that thiourea additions be made from a 1 per cent solution and additions of molasses also made from a dilute solution. It was reported by one licensee that the average additions to maintain a no-buff deposit were 0.03 g./l. molasses and 1500 cc. of the 1% thiourea solution for each 10,000 ampere-hours of plating, the sulfuric acid content being 0.5 N.

Summary

A cyanide copper strike is necessary when plating on steel parts.

Semi-Bright Copper Deposits

The addition of Triton No. 720 to a copper sulphate plating bath will produce a soft semi-bright deposit when used in conjunction with a small quantity of thiourea.

Plating Current

The current must be sufficiently high in a bath of correct composition to keep away from striations in low current areas, and low enough—or the work so protected—to stay away from burning. This is not important when using the semi-bright bath.

Temperature

The temperature should be as low as possible and not over 80° F. The luster falls off rapidly above that value.

Sulfuric Acid Content

Bright plating may be obtained with as little as 1.5 oz. of sulfuric acid per gallon; however, at such a value the resistivity of the solution requires excessive voltage for the current required so that temperature control is difficult without refrigeration. The maximum acid value is believed to be 6.6 oz. per gallon. Higher acid content promotes an orange peel effect in the deposit.

Thiourea Content

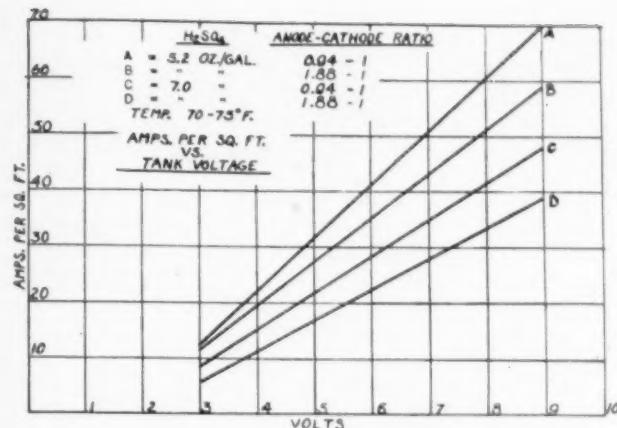
For maximum brightness without excessive brittleness, 0.04 g./l. of thiourea is considered optimum. A larger addition may accentuate orange peel and striations in low current density areas. In the semi-bright bath, 0.01 g. of thiourea is considered optimum.

Molasses

Molasses acts opposite to thiourea in that it reduces the tendency for striation, but a high content results in anode polarization or coating of the anodes so that current falls off. Its maximum value is believed to be 1.0 g./l., but it is known that lower concentrations (0.20 g./l.) may be used to good advantage.

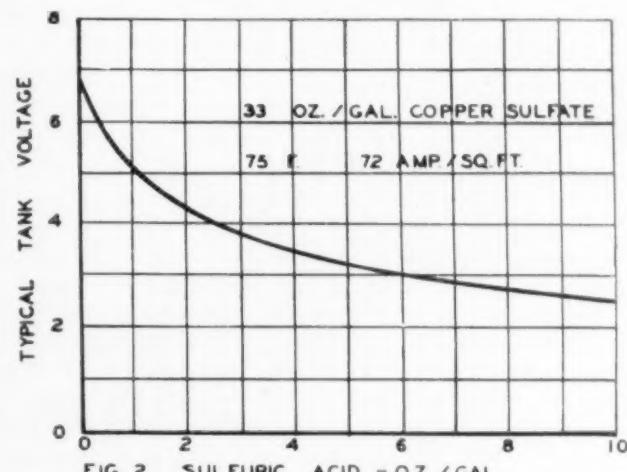
Agitation

Violent air or other agitation should be used.



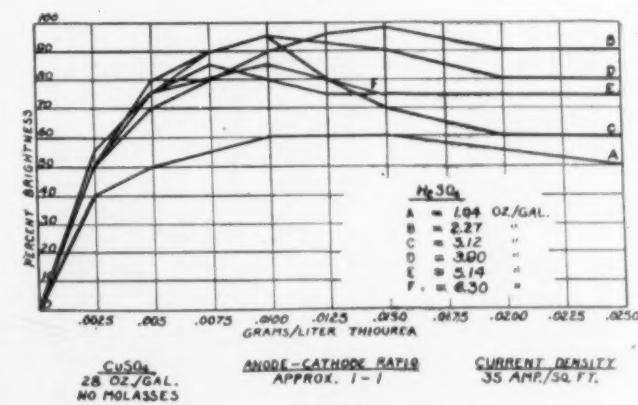
Graph 2

Graph 2 shows the voltage required to obtain certain amperages with the sulphuric acid content of the bath 5.2 oz./gal. and 7.0 oz./gal., and anode-cathode ratios 0.94-1 and 1.88-1.



Graph 3

Graph 3 indicates the tank voltage obtainable at various concentrations of sulphuric acid.



Graph 4

Graph 4 illustrates the brightness percentage of G. M. bright copper by comparison with bright nickel deposits and the influence of sulphuric acid with increasing amounts of thiourea.

Anodes

There should be as much exposed anode surface as possible. Anodes should be set with their edges to the work. In operation the anodes will become coated with finely divided copper or copper oxide which apparently does not cause rough plate.

Iron Impurity

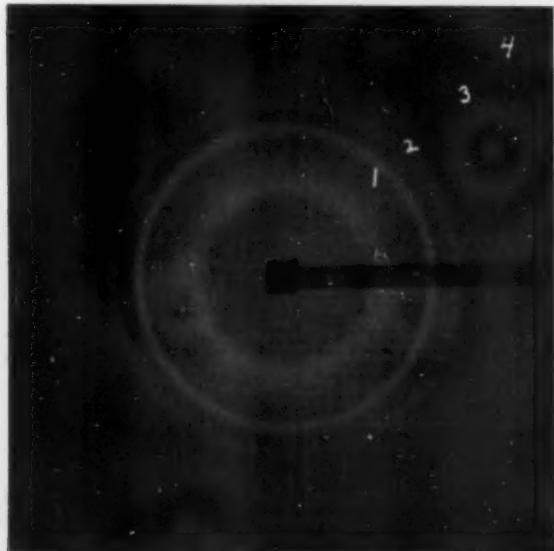
Iron as an impurity does not affect the luster of the deposit. As much as 30 g./l. of iron may be found in the bath, but at such a concentration the resistivity of the bath is so increased that temperature control of the solution becomes a problem. With the use of a low acid content, the attack on the backs of such parts as bumper parts and guards will be less, and therefore the build-up of iron in the bath will be slower.

The bumper bars on display were plated by Michigan Bumper Corp., at Grand Rapids. Bumper guards were plated by Parker-Wolverine, Detroit, Michigan. The inside door handles were plated in our laboratory. It is noticeable that G.M. bright copper can be operated far below its maximum brilliance and below the brightness obtained by buffing copper, but due to the crystal orientation, the subsequent layer of bright nickel will carry the maximum brightness obtainable from the nickel bath.

Structure

With the advent of bright platings, we have heard much discussion of grain size and crystal structure and their influence on the quality and appearance of electroplated deposits, so we decided to go briefly into this subject and, with the aid of X-rays, make a comparative examination of G. M. bright and semi-bright copper and copper plated from other baths. Our specimens were obtained by depositing foil a few thousandths of an inch in thickness on stainless steel.

Ordinary inspection of these 4 patterns would indicate that they are alike, and, therefore, the results are negative.



X-ray Diffraction Pattern No. 1

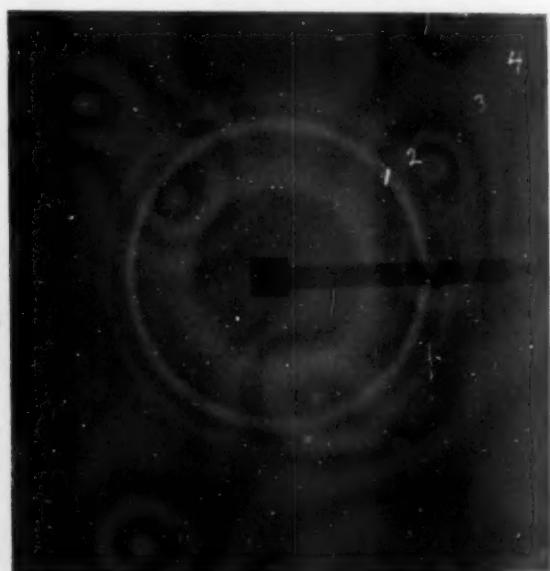
Pattern 1 is an X-ray diffraction pattern of G.M. bright copper plate. In this pattern ring 1 is more than twice as intense as ring 2.

However, the most common variation between metallurgical samples of identical chemical composition is in grain size. When the grain size is greater than a thousandth of a centimeter, the X-ray pattern consists of spots or spotty rings. Figure 5 is a pattern obtained from a sample of annealed copper, and, as is seen, it consists of spotty rings. These rings are numbered 1, 2, 3 and 4. In the range of grain sizes larger than a thousandth of a centimeter, where



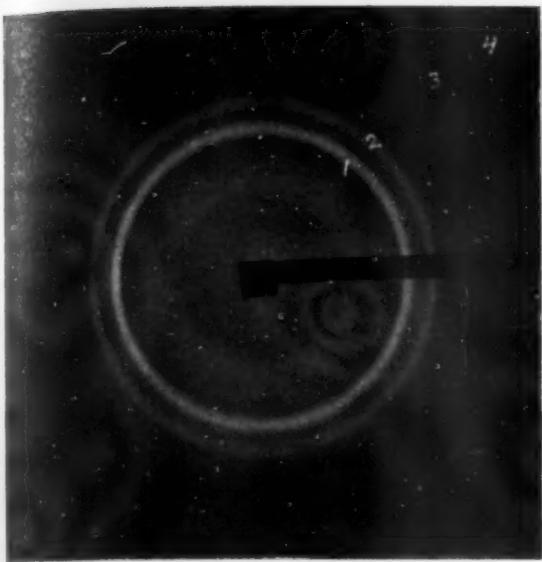
X-ray Diffraction Pattern No. 2

Pattern 2 is an X-ray diffraction pattern of G.M. semi-bright copper plate. Ring 2 is relatively more intense than in pattern 1.



X-ray Diffraction Pattern No. 3

Pattern 3 is an X-ray diffraction pattern of an acid copper deposit. Microphotometer measurement showed that ring 2 in this pattern is slightly below normal intensity for ordinary annealed copper.



X-ray Diffraction Pattern No. 4.

Pattern 4 is an X-ray diffraction pattern of copper deposited from a cyanide bath. This pattern, like sample 2, is a normal pattern, characteristic of ordinary copper.



X-ray Diffraction Pattern No. 5.

Pattern 5 is an X-ray diffraction pattern of annealed copper. The grain size of this copper is large enough to bring out the individual diffraction spots which compose the rings.

The X-ray patterns are spotty (as in Figure 5), an accurate estimate is easily made of the grain size from the pattern, and variations of as little as 10% in the grain size are readily detected. However, when the grains are smaller than a thousandth of a centimeter, the X-ray diffraction spots merge into continuous rings, as the slides indicate. Therefore, the actual grain size of our samples was not measured, but it is definitely established that the grain size of the plated specimens is in a range between a thousandth and a millionth of a centimeter because the patterns are insensitive to variations in the grain size.

Crystal Orientation

The second most common variation between metallurgical samples of identical composition is in orientation of the grains of crystals, which may be oriented at random or with a greater or less degree of preference for some special orientation. In the case of our samples there is no reason to expect a tendency for the crystals to line up along some axis lying in the plane of the sheet, as often happens in the case of rolled sheet or foil. When such a preferred orientation exists, it manifests itself by non-uniformity in the rings as one passes around their circumference. That is, the rings may be accentuated at six evenly spaced places, spaced 60 degrees apart around the circumference. No such preferential orientation is expected in an electroplated foil. Crystals deposited by electroplating are often oriented in a special manner on the base metal if the plating conditions are suitable. There is often preferential orientation in the direction perpendicular to the sheet rather than in any direction in the plane of the sheet in the case of electroplating. Preferential orientation of this type manifests itself in the X-ray patterns by causing the various rings to have different relative intensities from those found in the pattern of ordinary copper with random orientation. For example, in ordinary random-grained copper, such as the annealed copper sample (Figure 5), ring 2 is 53% as intense as ring 1.

In order to investigate this point, the negatives were mounted in a microphotometer, and the relative opacity of the film for rings 1 and 2 compared with the background was measured. The results were as follows:

Ratio of film opacity for rings 1 & 2

Sample No. 1 G.M. Bright Copper	6
" " 2 G.M. Semi-Bright Copper	2
" " 3 Acid Copper	3
" " 4 Cyanide Copper	2

This indicates samples 2 and 4 are ordinary copper with random orientation, but G.M. bright copper has a pronounced preferred crystal orientation in which the cube faces lie parallel to the metal surface, while ordinary acid copper (sample No. 3) shows only a scarcely detectable tendency towards this type of preferred orientation. This

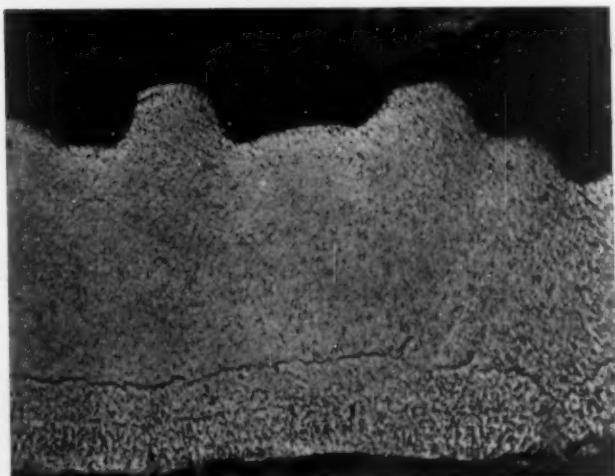


Plate No. 1. Cross Section of Cyanide Copper Plate.

point is graphically illustrated by the metallurgical photo-micrographs which will be shown.

Microscopic Study

Plate No. 1 is a sample of copper deposited from a cyanide bath and shows nodular formation requiring considerable buffing and loss of metal to obtain a smooth surface.

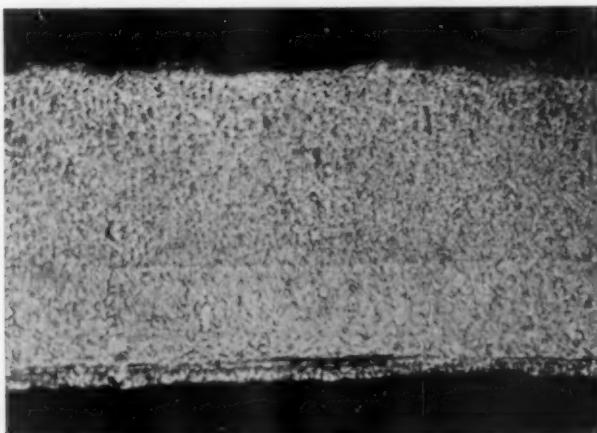


Plate No. 2. Cross Section of G. M. Semi-bright Copper Plate.

Plate No. 2 is a sample of G.M. semi-bright copper. Note the similarity of the grain structure to the sample plated from a cyanide bath. This corresponds to the slides showing X-ray diffractions.

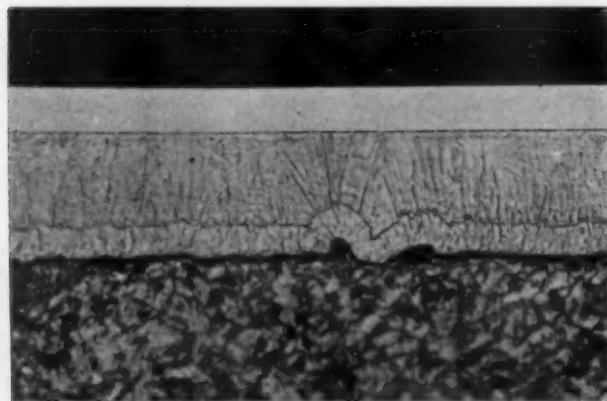


Plate No. 3. Cross Section of Acid Copper Deposit.

Plate No. 3 is a section of a bumper bar plated at Toledo from a regular acid copper bath containing molasses. The orientation of the crystal structure is definitely perpendicular to the basis metal.

Plate No. 4 is a section of a bumper bar plated at Toledo from the G.M. bright copper bath. Here, as explained under X-ray diffraction, due to the influence on the crystal structure exerted by the thiourea in the plating bath, the crystals are formed horizontally to the basis metal and have the appearance of layers.

The authors wish to acknowledge and thank, for information and samples, the Gordon Mfg. Co., Houdaille-Hershey Corp., Michigan Bumper, Parker Wolverine, and Standard Steel Spring Co.; also, Messrs. W. S. Erwin and W. L. Grube for their thesis, and Dr. W. T. Sproull for his work on X-ray diffraction.

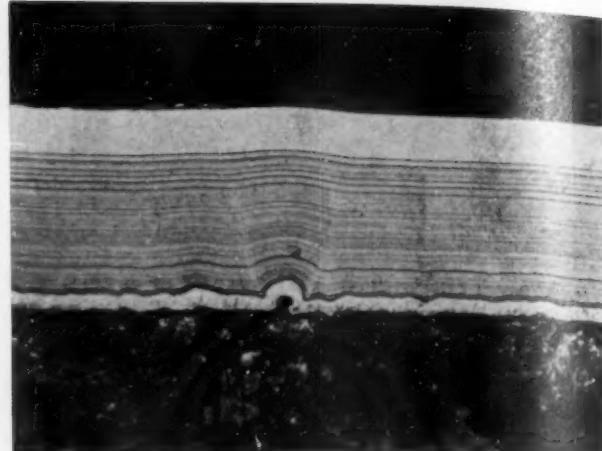


Plate No. 4. Cross Section of G. M. Bright Copper Plate.

Silvered Designs Applied to Glass

Beautiful designs on glassware or other glass surfaces can be produced by the following method, according to a recent report of the American Silver Producers' Research Project: Fine silver powder and lead borate are mixed with lavender oil and the mixture is brushed on the glass surface in such a way as to form the design desired. When dry, the glass is heated to a temperature high enough to fuse the mixture to the glass. Subsequently, the glass is immersed in a common silver cyanide plating bath from which silver is deposited on the fused design in whatever thickness is desired.

An exact duplication of this process on plastics presumably would not be feasible because of the high temperature which appears to be necessary, but it is not unlikely that a method for accomplishing a similar result on plastic can be worked out. The Project under direction of Handy & Harman is prepared to cooperate with established manufacturers in developments involving promising uses of silver.

Copper-Silver Alloys Make Good Contacts

Copper increases the hardness of silver and silver-copper alloys which are among those most extensively used for electric contacts. Copper somewhat increases the film-forming tendencies, but, where contacts act with sufficient wiping action, the film is easily destroyed and the surfaces remain clean. Coin silver, which contains 10 per cent of copper, is hard enough to possess high resistance to wear and is used where atmospheres are free from sulphur. The electrical conductivity of coin silver can be increased from values around 70 per cent to approximately 100 per cent by appropriate heat-treatment. Other metals beside copper are alloyed with silver for use in contacts and the refractory metals are added in sintered mixtures to promote arc resistance. Numerous details in this regard are contained in extensive reports compiled by The American Silver Producers' Research Project and further work is being continued by the project under the direction of Handy & Harman.

Metals of Antiquity

PART II—CONCLUSION

By JOSEPH DANFORTH LITTLE

HOMER flourished nearly 1000 years before Christ and the art of working in iron was evidently a common one in Homeric times, for he mentions it in his writings. That delightful old gossip, Herodotus, who was born over 400 years before the Christian era, often mentions iron.

There have been many superstitions about iron. Pliny, who was born in 25 A. D., wrote that nails extracted from a tomb and driven into the threshold of a house would keep away nightmares. Even today many nail an iron horse shoe over the door for luck. The Persians in the army of Xerxes in the fifth century B. C. wore iron as well as bronze scale armor. Plato (400 B. C.) states that both bronze and iron were the metals of war. Iron tools were used at the time of the Trojan War which was over 3,000 years ago. The Greeks were wonderful workers in iron, although no work of Greek art in iron has come down to us, yet passages in their literature indicate that they practiced the art of casting, welding, embossing, inlaying, and tempering iron.

The art of polishing iron by the Greeks is suggested by the prophet Ezekiel in his denunciation of Tyre. The art of hardening iron by plunging it, while hot, in cold water, is spoken of by Homer. Iron was extensively used by the Greeks in the construction of ships, chariots, engines of war and agricultural implements. Excavations at Pompeii, which was destroyed in A. D. 79 show the uses of iron at that early date and many of them were identical with our own. There are no records of the methods of extracting iron from ores used by the most ancient people, though Egyptian monuments furnish some data. Egyptologists tell us that iron was made and used in Egypt in the era between 7,000 and 6,000 B. C.

Iron Was Mined in America Before 1622

Iron was probably the first native metal used in America. It was first located in Virginia. John Berkeley set up the first furnace in America at Falling Creek, Virginia, and began producing iron. History tells us that the furnace was destroyed in 1622 and all who worked with him were massacred except his young son. As early as 1630 a deposit of iron was found in Saugus, Massachusetts, which was so located as to be easily accessible. The first furnace in New England was built by John Winthrop Jr., who organized a company which set up a crude smelter and foundry, which produced both wrought and cast iron. This plant supplied the colonists with iron for pots, kettles, fireplaces, and farm tools and also hinges and latches. It was one of the first New England industries. Iron was so much needed at that time that it was voted to exempt it

from taxation and the workmen from military service. The inhabitants of the town were so delighted to have the furnace, that the land upon which it was built not only was tax-free but it was donated.

Later furnaces were built in other colonies and pig and bar iron were produced in this country and were shipped to England. The English people, realizing that iron exporting to America was slipping away from them, had a law passed in 1750 prohibiting any American iron maker from melting and refining pig iron except what was shipped from England. This they thought would end this young industry of the colonies and the first settlers of this country would then be obliged to buy new tools, also household and farm implements, from England, but the people of the colony refused to accept this, and for years articles of iron were made in this country surreptitiously. When the Declaration of Independence was signed, severing all connections with the mother country, the trade of the iron worker became a most important one for not only articles of utility in iron, such as fire shovels, trammels, pot hooks and many other household articles were needed, but also nails for ships and houses. Paul Revere, the patriot, was one of the early nail makers. He supplied the bolts and nails for the old Constitution which was affectionately called "Old Ironsides."

Lead

Lead in the form of ore is widely distributed throughout the world. It was mined and used long before history began



Fig. 5. Ancient vessels of silver of the Egyptian period about 300 B. C.

to be recorded. It was known to the prehistoric races and to the ancient Assyrians, Egyptians, Greeks and other nations of antiquity. The Chinese made their first money of it about 2000 B. C. The Greeks used lead for many purposes. It is mentioned twice in the Iliad and Herodotus tells us that Queen Nitocris, at Babylon, built a bridge across the river "of stone, bound together with lead and iron." Lead has always served a very useful purpose, to counterfeit coins, for thousands of years. Herodotus speaks of "leaden money plated with gold."

The Romans made extensive use of it in pipes, for it was used in the elaborate system for the supply and distribution of water in cities and in the construction and equipment of baths, which formed an important feature in the social life of the Romans. In many of the old Roman houses, water was piped, just as we pipe the water in our houses today. These old water pipes varied from two or three inches in diameter to eighteen inches. Pipes of the smaller sizes have been dug up by the hundredweight in various parts of the Roman empire. They also used lead for roof coverings, in masonry, for coffins, tanks and gutters. Lead water pipes, of Roman make, have been found frequently in England. These were used by the Romans from the second to the fourth century.

Lead was used in the days of Pharaoh and is still used by the Egyptians to glaze pottery and to make solder and ornamental objects.

It is frequently mentioned in sacred scripture. It is first mentioned in Exodus where it says that the Egyptians "sank like lead" in the Red Sea. (Chap. 15, V. 10). Later lead is mentioned with gold, silver, copper, iron and tin. (Numbers 31, V. 22). Job, Jeremiah, Ezekiel and Zachariah all make mention of the metal in their writings. Job makes reference to its use in preserving a permanent record of events by lead being melted and poured into letters deeply cut in a rock. (Job 19, V. 24). This metal has always been the plumber's friend and the name of his craft comes from the Latin word for lead "plumbum." It has been used in printing since the invention of movable type in the fourteenth century and it is so used today. Today lead is one of our most useful metals.

Tin

Tin occurs in relatively few localities in the world and ranks as the rarest of all common metals. It is a heavy metal, silver white in color and when melted with copper makes the alloy known as bronze.

With many common alloys, it was known and used long before history began to be recorded. It has many indispensable uses, in making the wheels of industry and of our commerce go round.

It appears to have been one of the earliest discovered metals and is mentioned in sacred scripture in connection with gold, silver, brass, lead and iron. (Numbers 31, V. 20). It was known to Hiram, King of Tyre, at the time King Solomon's Temple was built.

The Phoenicians, who were the merchant adventurers of their times, sent galleys from the Mediterranean to buy tin from the natives of Cornwall (England) in exchange for salt, crockery and bronze wares. This was before the time of Herodotus.

Julius Caesar was led to invade England by reports of valuable mineral deposits there, particularly in the

town of Cornwall. These mines of Cornwall have been known and worked from the bronze age. Tin mining is, therefore, England's oldest industry. It might be claimed that the world's first tin came from here, for the "tin" of the Bible corresponds to the Hebrew "bedhil," which is really copper alloy and was known as early as 1600 B.C. One of the oldest mines in Cornwall, the Levant mine, has a gallery more than 2,000 feet below the sea level, which bores under the Atlantic ocean to a point a half a mile from shore.

Another important source of tin, in the ancient world, was Spain. The Phoenicians made regular trips to Spain to obtain a supply of tin. Aristotle, Homer and also Herodotus all mention tin in their writings.

Gold

The first metal to be used by prehistoric man was undoubtedly gold, because it occurs native and unlike copper and iron, it did not have to be mined or smelted. There was no need for him to find a way to get it from the ores. He found it in the river beds, gravel heaps and drifts. Long before history began to be recorded, man was using gold. As a matter of fact, almost every one of the base metals appear to have been discovered before records began to be made. Man from earliest times seems to have wanted and used gold for ornaments, for even in those early days people liked to wear ornaments, not only of gold but of ivory, jet, amber, pearls and even ornaments of colored shells. Just why man in these early days wanted gold is hard to understand, for it was of no use to him for making tools, it being too soft for that purpose. Probably he was attracted to it on account of its shiny yellow color and he found it was soft and malleable and could therefore be worked with his primitive tools into ornaments; for primitive men and women all through the ages have loved to decorate themselves. Nevertheless, men have sought it, just as men today seek it, and all down through the ages gold has been the everlasting lure of all the races and generations and it will probably always be the sole commodity that anywhere and everywhere can be exchanged for any items one might desire.

Gold does not rust as iron or tarnish as many bright metals do. It may be hammered into sheets so thin that two hundred thousand of them will make a pile only one inch high and a single grain of gold may be drawn into wire so fine that it will be over five hundred feet in length. It is the most ductile of all metals. A film of gold has been produced of a thickness of 0.000,000,87". It is the most malleable of all metals, and it is so extremely malleable that a grain of gold can be worked into leaf covering six square feet and only 0.000,003,3" thick.

Just when the Egyptians began to use gold for ornaments is a matter of conjecture but the exquisitely wrought gold bracelets found on the arm of the queen of King Zer, successor to Menes, takes us back to about 6000 B.C. The Egyptians were wonderful workers in gold as early as 3500 B.C. They had attained considerable skill in making gold jewelry and also in decorating stone vases, which have been found with gold rims, handles and bases. Also in this period they prepared gold sheets for covering various articles of wood and stone. Some of the articles on display in the Metropolitan Museum of Art in New York City indicate that these ancient people were men of skill and their

work shows a high standard of craftsmanship. In one of the ancient pyramids, which was built between the years 2099 and 2016 B.C., were found exquisite examples of the goldsmith's art, such as gold bracelets, necklaces, pendants, strings of gold beads and lion claws in gold. All these indicate the splendor of the age in which they were made.

Gold is spoken of three hundred times in sacred scripture. The earliest allusion to it is found in Genesis (Chap. 2, V. 11) where it reads that the river Pisen "compasseth the whole land of Havilah, where there is gold; and the gold of that land is good." In the same book (Chap. 13) we read "and Abram was very rich in cattle, in silver, and in gold." It is recorded (1 Kings 10-10) that the dusky Queen of Sheba, when she paid a visit to King Solomon, gave among other things one hundred and twenty talents of gold. This at the present price of gold would be about \$250,000. A tidy little gift for the king. In Verse 14 of the same chapter it says "the weight of gold that came to Solomon in one year was six hundred and threescore and six talents of gold." At the present price of gold this would be worth over \$1,250,000. Quite an income for one year.

Wonderful specimens of work in gold by the goldsmiths of five thousand years or more ago, when the Sumerian Dynasty ruled in Mesopotamia, may be seen in the museum of the University of Pennsylvania. These were discovered on the site of the ancient city of Ur of the Chaldees, famous as the home of Abraham. The collection is one of the finest ancient Egyptian collections in the world. Royal daggers of gold, elaborately chased and ornamented, gold head dresses, rings, anklets, earrings, bracelets, pins and many other articles of gold, all found hundreds of feet below the surface of the earth, in the old tomb of King Mes-kalem-dug. Archeologists tell us that some of these pieces date back to 8000 B.C.

Varro, an ancient writer (born 116 B.C.), tells us of the gold furnishings possessed by an individual. A certain Ptolemaeus, a private man, gave a dinner to Pompey (106-48 B.C.) during his campaign in Judaea, at which one thousand guests were entertained. Each guest had a gold cup to himself and these were changed for others at every course.

From earliest times of which we have any record, gold was abundant amongst the nations of Asia Minor, as constant allusions to it in Homer's poems sufficiently attest. Homer does not mention the sources whence it was obtained.

When Brazil was first discovered by the Portuguese, the rude inhabitants used fish hooks of gold. Iron and steel were unknown to them and they gladly exchanged gold fish hooks for those of steel.

When America was discovered by Columbus, gold was well known by its inhabitants. The Chinese have used it from time immemorial. The Medes and Persians were remarkable for their love of gold.

Silver

Silver is as widespread as gold, occurring in nearly all volcanic rocks but is rarely found in the native state, whereas gold remains unaltered by the action of the elements and is often carried long distances from its original place of occurrence. Silver, on the contrary, is only



Fig. 6. Work of ancient goldsmiths of Costa Rica. Exhibit at the American Museum of Natural History, New York.

to be found in the rocks where it occurs. It is therefore necessary to obtain it by subterranean mining. Shafts are driven and the ore is brought to the surface and by use of various processes the silver is extracted, refined and made ready for commercial purposes.

Pure silver has a beautiful white color and lustre. It is almost as plastic as gold and like it, is usually too soft as found in nature to make durable objects that require lightness and stability of form. It is harder than gold but softer than copper. The softness of this metal is overcome by alloying it with a little copper. An alloy of 925 parts of fine silver and 75 parts of copper is called 925/1000 fine and this is known as "sterling silver" which is the government standard.

Silver, when found in relatively pure state, is readily adapted to use. That is why it was among the first of all metals to serve mankind. Pure silver is extremely soft and ductile and may be rolled or beaten into very thin sheets or drawn into very fine wire. It is usually found with other metals, such as copper, lead and gold. Of all metals it has the whitest color, the highest electrical and thermal conductivity. Silver is probably the most widely used precious metal for electrical contacts, for the reason it has the lowest electrical resistivity of any metal and is superior to all others as a conductor of heat, two extremely important factors in the making of electrical currents.

It has always been used as a medium of exchange, and has been used more extensively for coins than gold. We have a record of the first payment ever made in silver, for sacred scripture tells us that Abraham paid in silver for a grave for his wife. (Genesis 23-16). That transaction took place over 4,000 years ago.

Like gold, silver was an article of extensive commerce with many of the ancient nations. The ancient Phoenicians, we are told, obtained a great deal of their silver from Spain where it abounds today. Some of the ornaments found in the royal tombs of Chaldea, which were built about 4000 B.C., indicate to us that silver was used at that early date. An old inscription records the fact that silver was used as a medium of exchange by these ancient people. In the British Museum are many wonderful treasures that reveal the beauty and splendor of the Chaldees more than 5,000 years ago. One of the most interesting articles is a silver dish which is thought to be among the oldest discovered. It is engraved with a beautiful pattern and it is difficult to realize that the art of the silversmith had reached such heights in the period about 3500 B.C. The countries that

produced silver for these ancient people, we are told, were Spain, Hungary and Transylvania.

Silver was known to the ancient Greeks at a very early date. Like copper it was known to pre-historic man but it was probably not discovered by him until after he had used gold and copper. The Greeks not only made articles of beauty and utility of silver but they were the first to strike coins of silver, for they struck coins as early as 869 B.C.

Xenophon (born 435 B.C.) mentions the famous mines at Laurium in Attica, in Greece, and speaks of the large amount of silver taken from them, and tells us the mines were old in his day, as the piles of rubbish and slag around them would testify. So these mines were famous long before the Christian era. History says that at these mines a thousand slaves were kept and hired out to those who worked the mines. The mines were leased and the lessees under the state paid their royalties in the form of a poll-tax on every slave employed. The slaves were kept at work both day and night and were cruelly treated and died off very rapidly.

In these early days silver seems to have been prized almost as much as gold. The ancient Romans seemed to have desired silver more than they did gold, for when the armies of Carthage had been defeated and forced to pay tribute to Rome, they demanded that the tribute be paid in silver and not in gold. The Romans made, long before the Christian era, articles of beauty and utility, also coins and mirrors of silver. The rich and powerful kings and priests of the ancient world used goblets, plates, bowls and dishes of silver on their tables and in their religious ceremonies. About two thousand years ago, the elder Pliny (23 A.D.) lamented that "nowadays we only value wrought silver for its age, and reckon its merit established only when the chasing is so worn that the very design can no longer be made out."

In early days the Egyptians valued silver higher than gold. It was scarcer in the land of the Pharaoh than gold. The methods used in the refining and manipulation of both gold and silver are practically the same as those used thirty centuries ago. While silver was scarce in Egypt, nevertheless it was used to quite an extent and was probably imported from Silesia in Asia Minor. During the wanderings of the Israelites it is frequently mentioned and was employed like gold in the manufacture of ornaments and idols.

Silver in the Bible

Vast amounts of silver are mentioned in sacred scripture. Silver is mentioned in the Bible over 200 times. It is not mentioned by name until the time of Abraham, when we are told that "Abram was very rich in cattle, in silver, and in gold." (Genesis 13:2). In his day, silver was a medium of exchange by weight rather than in the form of coined money. There is Biblical evidence of the quantity of Egyptian gold, silver and bronze work of those times, for the furniture of the tabernacle made by Moses was covered with gold, and the making of gold castings and manufacture of various other objects of gold are referred to in Exodus (Chapter 25). There can be no doubt that the metallurgy practiced by the Israelites was derived from the Egyptians, among whom they lived for centuries and the excellence

of whose work is evident from examples that have come down to us.

Since the first silver was taken from the ground, over 18,000,000,000 ounces have been recovered. It is estimated that about one third of this is in monetary stocks, including bullion reserves, one third in the hoards, including articles of beauty and utility, and one third has been mislaid in unknown caches or wasted through use, carelessness or mishap.

New Possibilities for Silver Coatings

Silver coatings can be applied by several methods, some of them rapid and quite inexpensive. Silver itself is highly resistant to corrosion, but, when applied in very thin coats, is likely to be porous, in common with similar coatings of other metals. Such coatings can be used, therefore, only where chemical attack or galvanic action are not severe. Coatings applied by chemical reduction and by vapor condensation are only a few millionths of an inch in thickness and are quite porous, but electrolytic coatings can be made relatively non-porous and entirely suitable for many purposes when 0.001 in. or sometimes even less in thickness.

Silver has been mentioned as a possible substitute for tin in coating cans and can be so used successfully when the higher cost as compared with tin is justified. It has been so applied on a very limited scale in applications where tin does not provide adequate protection.

For larger containers, such as pails or drums where repeated use is involved, electrolytic coatings of silver approximating 0.001 in. in thickness are feasible, both economically and from a technical standpoint, for a wide range of products and containers with such coatings can be used in contact with some products with which the usual tin and other coating materials are not adequate. Under some circumstances, silver is known to prevent spoilage of certain products which deteriorate in contact with other metals.

Silver is now being substituted for electrolytic coatings of nickel, chromium and other metals the supply of which is restricted and it is feasible to employ thin coatings of silver clad on steel backing in place of brass and other non-ferrous alloys which are reserved for war applications.

Although the whole subject of coatings, whether for containers or for other applications, is a complex one, a great deal of research relating to the use of silver for coatings has been done by the American Silver Producers' Research Project as well as under other auspices. Data thereon, collected by the Project, are available to manufacturers and the Project, now being directed by Handy & Harman, is prepared to cooperate with manufacturers interested in promising applications of silver either in coatings or for other purposes.

Correction

Two errors were made on page 358 of the July issue in the article entitled "Hard Chromium Plating" written by Austin Fletcher. Under "The Steps in Chromium Plating Dies", step No. 9 should read "Reverse treatment in chromium solution" instead of "Re-rinse in chromium solution". The current density given in step No. 10 should read "4 amp./in.²" instead of "4 amp./ft.²".

Kinks and Reminders

By LESLIE L. LINICK

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Chicago, Ill.*

IN THE past ten or twelve years the electroplating industry has made greater advances than it did in all of its previous ninety odd years. Articles appearing in the literature, especially the trade papers, contain lately much material which cannot be easily assimilated by the average plater, and some of the old-timers have become more or less disinterested in the technical or scientific references. The author, of course, intends no such "lack of appeal" and the reader is advised to digest as much as he can comfortably understand. The left-over material should do him no more harm than would the unordered dishes listed on a restaurant menu. And I have heard it said that frequently a "scientific" plating shop foreman does no better than the experienced "regular".

The writer is technical editor of a paper which circulates among jewelry manufacturers and precious metal technicians. Many of their finishing problems are of interest to the plater and will bear repeating. Other data are probably new to the readers of METAL FINISHING.

Activated Substances

Industrial liquids such as plating and cleaning solutions, baths for surface removal or coloring, often contain non-filterable impurities which, while present in such finely divided particles or in form of liquids in such small quantity that their existence cannot be detected by ordinary means, nevertheless produce effects which may completely change the character of the product.

The changes thus obtained may be desirable or not. Objectionable, adsorbable impurities can be taken out of solution by use of activated materials, such as charcoal, bone-char, carbon, ash, and other substances. When a variety of impurities is to be re-

moved, various activated materials may be used together, thus replacing several different treatments such as filtering, chemical action, etc. An important point to be considered is the possibility of reaction other than the adsorption intended. Thus in a gold plating bath, the use of activated zinc will precipitate the gold unless excess cyanide is added, in which case both the gold and the zinc will be part of the solution.

Activated carbon, however, will remove practically all organic impurities without interfering with the metal cyanide except perhaps the mechanical trapping of some of the gold or actual adsorption in solutions low in cyanide.

In the treatment of nickel solutions, an equal quantity of carbon and diatomaceous earth is recommended. About two to four pounds of each material per 100 gallons of bath will adsorb organic contents in about two hours if used in a separate storage tank and not in the tank used for plating. It is then filtered and returned to the plating tank.

The spent adsorption medium may be used as a mechanical cleaning or polishing medium in place of or in connection with powdered pumice, but not until any possible harmful plating chemicals have been washed out. When activated materials are employed in precious metal solutions, it may pay to save the used material for the refiner. Activated carbon of which there are several distinct types, adsorbs the following substances from an acid nickel bath: formic, acetic, tartaric, citric, succinic, oxalic, lactic acids, as well as phenols, cresols, glycerin, gums, gelatines and glues, in fact practically all colloids and polar substances.

Some of the various kinds of activated carbon will adsorb particular substances under most but not all conditions. Among these are: benzoates, salicylates, most organic dyes, many

proteins, edible as well as mineral and essential oils, arsenicals, alcohols, ureas and starches. Carbon will adsorb platinum, palladium, osmium (and gold) from dilute, highly alkaline solutions in presence of activated zinc moss. The other three platinum metals, rhodium, iridium and ruthenium, are not so well adsorbed.

Sink strainers for precious metal reclaiming, such as used by jewelry manufacturers, may contain as much as several inches in height of activated zinc-moss. There are several types of each activated material and the one most suited to a certain purpose should be used to the exclusion of all others. Price of the material has no connection with its ability to do a certain type of work. Should activated material float or remain suspended in a solution under treatment, additional material will overcome this fault in almost all cases. In other cases, admixtures such as magnesium silicates or activated clays may be required.

Catalysts

A far greater number of substances than generally supposed, act as catalysts. Positive catalysts start or support a reaction or increase its rate. Negative catalysts interfere with, slow down or stop a reaction. Some catalysts act only temporarily. Among positive catalysts are palladium, platinum, active nickel, ultra-violet light, sunlight, water, etc.

Chlorine and hydrogen combine slowly in the dark, while in sunlight they combine with explosive violence. Water can also be a negative catalyst as in the Grignard reaction. Any substance, which by its mere presence changes a reaction, remaining itself unchanged, i.e., not entering into the reaction, is called a "catalyst". Thus it is possible for an insoluble substance to have an effect in a solution by its presence alone.

Nickel Solutions

Hydrogen peroxide destroys many organic substances. This chemical may be formed within a nickel bath by the action of ultra-violet light upon part of the solution. Hydrogen peroxide acts as both a reducing and an oxidizing agent, depending upon conditions. Since it reduces permanganate to manganous salt, potassium permanganate should not be used together with hydrogen peroxide in a nickel bath. A solution containing permanganate cannot be successfully filtered through paper because all organic substances are oxidized by it, cellulose (paper) being changed, in part at least, to oxalic acid.

Do not use either of the above oxidizing agents at the same time with activated materials. Combustion or explosive reaction may follow mixing of these as well as with hypochlorites, the bleaching solutions sold in grocery stores, in absence of free water.

Under powerful oxidizing conditions as well as in the electrolysis of solutions containing sulphuric acid, ozone (O_3) is formed. Its production is favored by high current densities. Ozone itself is a powerful oxidizing agent and, therefore, decomposes or destroys organic matter. Decomposition of organic matter favors the formation of nitrates. Nitrates interfere with deposition of nickel.

Filtration or precipitation to insoluble compounds eliminate this objectionable matter. A precipitant of this type is sold under the name of "Ductyl".

When sodium chloride is called for, do not use table or kitchen salt. These usually contain matter which would be considered an impurity in a nickel bath, principally magnesium chloride. This is the material which causes salt to cake in moist atmosphere. Many of the table salt producers, rather than remove the magnesium compounds, add sodium bicarbonate to prevent lumping. Carbonates especially, and less so sodium and ammonium compounds, cause brittleness in the nickel deposit, most noticeably at increased current densities.

Crystal boric acid is purer than the powder for the same reasons given above.

To test nickel salts for iron content, add a concentrated solution of ammonium thiocyanate to a strong solu-

tion of the nickel salt. Next add a few cc. of a mixture of amyl alcohol and ether and shake well. When the solution has settled, the upper alcohol-ether layer should be colorless. If it is red, iron is present.

Phenyl-related tantalum, molybdenum and tungsten compounds are used for brightening nickel baths. They require breaking in by electrolysis over a period of days before proving useful. Because of this delay, users were inclined to employ an excess of the brightener, which proved unwise and wasteful.

A manufacturer of such a compound (Tantol), therefore, added a small quantity of a temporary brightening agent so that an immediate effect would be obtained. The action thus is similar to that of the inks which contain ferrous salts of gallotannic acid. The liquid has no color except after exposure to air for some time. Therefore, ink manufacturers add a black or blue dye to give it an initial color on paper. The dye alone would prove very short-lived.

Solvents for Metals

A list of "proper solvents" as well as the metals attacked by water, will be of interest:

REAGENTS FOR DISSOLVING OF COMMONLY USED METALS

Metal	Proper Solvent	Remarks
Aluminum	HCl	Also caustic alkalies
Antimony	Aqua regia	
Bismuth	HNO ₃	
Cadmium	HNO ₃	Very slightly soluble in water
Chromium	Commercial HCl	
Cobalt	Commercial HNO ₃	
Copper	HNO ₃	
Gold	Aqua regia	Also bromine and chlorine water
Iridium	Aqua regia in presence of formic acid	
Iron	Commercial HCl preferably in contact with platinum	
Lead	HNO ₃	
Manganese	Any dilute mineral or organic acid, also water	
Mercury	HNO ₃	
Nickel	HNO ₃	Danger!
Osmium	Fuming HNO ₃	
Palladium	Aqua regia	
Platinum	Aqua regia	
Rhodium	Aqua regia, preferably with a trace of HF	
Ruthenium	(Alloy with Pt) aqua regia	
Silver	HNO ₃	
Tantalum	HF 2 parts, HNO ₃ 1 part	
Tin	HCl	Preferably in contact with Pt.
Zinc	Any commercial mineral acid	

Halogens

Fluorine and chlorine oxidize all metals. Bromine and iodine oxidize all except the noblest. Fluorine is the most powerful of all chemical oxidizing agents, the only substance superior in this action to ozone. Chlorine is the most suitable oxidizing agent for use in the nickel bath, usually present in the forms of nickel chloride and hydrochloric acid and in common salt and potassium chloride. Chlorine may be prepared by dropping hydrochloric acid on potassium permanganate (danger!).

General Notes

The water solution of barium hydroxide known as "Baryta-water", is often employed as a standard alkali in quantitative analysis. The insolubility of the barium carbonate keeps the solution free from carbonate ion which is often found present in sodium hydroxide and which is objectionable in titrating acids.

The insoluble carbonate compounds precipitated in cyanide solutions by means of certain phosphates and sulphates may be used as a polishing medium. All free cyanide should be removed by washing. Silver polish

is essentially of such composition. For speedier effect, such as is required in initial cleaning, it may be mixed with powdered pumice.

Nickel, cobalt, iron, platinum and palladium occlude or dissolve hydrogen gas to a remarkable degree. Under favorable conditions, one volume of palladium will adsorb nearly 900 volumes of hydrogen at room temperature.

The first three metals are rendered passive by powerful oxidizing agents, such as concentrated nitric acid. Passive iron will not dissolve in concentrated or dilute nitric acid. In order to activate the metal, a dip in a solution of common salt may be used.

Metallic mercury combines directly with bromine forming mercurous bromide, which is insoluble. (Danger in handling of bromine!)

If zinc will not dissolve in dilute hydrochloric acid, touching it with platinum or newly plated nickel will cause immediate solvent action.

When gold and platinum are to be separated from solution, neutralize the solution, then precipitate the platinum with ammonium chloride. Filter the platinum and precipitate the gold from the remaining solution with ferrous sulphate.

An extremely sensitive test for gold in solution is: 2 drops of dilute gold solution or of the liquid supposed to contain gold, 3 drops each of arsenic acid and ferric chloride solution and 4 drops of commercial hydrochloric acid. Add enough water to total 100 cc. Drop in a small piece of zinc and shake. If gold is present, the solution around the zinc will become pink to magenta to purple over a period of a few to ten minutes.

The largest lump of silver ever found in nature was discovered by an Indian in Sonara, Mexico, when that province was still a possession of Spain. The lump of silver weighed 2750 lb. Because of a dispute over its ownership, the entire mass was appropriated by the Spanish crown.

Nine and one half pounds of silver go into the recoil mechanism of each 155-mm gun and each 8-inch Howitzer turned out by the Ordnance Department. Since the World War, when the army learned this use of silver from the French, the Ordnance Department has been following the practice. Many other substitutes for silver have been tried, some of them which have been developed to the point where they could be used. But no substitute meets the requirements as well as silver. This is due to the metal's low coefficient of friction, its softness and its noncorrosive quality.

SPECIAL GLASS FOR TANK LININGS



Workman pouring acid in a tank lined with new chemical resistant and structurally strong glass.

WITH the present shortage of materials regularly used for the coating and construction of tanks, industry is faced with the problem of what to use in their place. In view of this situation, a great deal of interest is being shown in the use of glass—Tempered Carrara Structural Glass—as a substitute for these materials in tank fabrication. The glass is a development of Pittsburgh Plate Glass Co., Pittsburgh, Pa.

It has long been known that glass is impervious to most chemicals and, therefore, a logical material for tank construction. However, certain obstacles previously had retarded the development of its use in this field. Notably, glass lacked the requisite strength and toughness of other materials. Also, there was the problem of joining glass to effect a leak-proof installation.

Today, these obstacles have been overcome. The tempered glass, with four times the strength and toughness of normal glass, has been found to be perfectly suited for the fabrication of tanks. Its ability to withstand tem-

perature variations over a considerable range is another factor in its favor. As for the joining of glass edges, this is no longer a problem, for methods have been worked out to handle the satisfactory joining of glass under varied operating conditions.

The structural glass is available in slabs as large as 4' x 9' and in thicknesses up to 1 $\frac{1}{4}$ "—is ideal for problems involving acids, alkalies, fungus, chemicals. It does not rot or deteriorate, and will not contaminate the chemicals it holds. It provides a strong, smooth surface which is nonporous and nonabsorptive and eliminates the problem of maintenance. The glass has none of the disadvantages of membranous materials, nor does it present the joining problems characteristic of refractory tank linings.

As a noncritical material, the tempered structural glass provides an excellent substitute for critical tank materials. It also bids fair to be the solution to a large majority of tank troubles not only for the duration of the war, but in normal times to follow.

Controlled Power For Plating

By LOUIS W. REINKEN

Chief Engineer
W. Green Electric Co.
New York

TO ILLUSTRATE the control possible for electroplating when using selenium-type rectifiers as power sources, the following problem and its solution are presented.

Problem: The customer plans to hard chromium plate rather large parts, each of which requires about 1800 amperes and a voltage range up to 12 volts maximum. The following conditions must be met:

1. It is necessary to control the thickness of deposit within very close limits, preferably on an ampere-hour basis, rather than on the basis of time alone.

2. During the plating cycle, it is necessary to increase the voltage at definite intervals based on the progressive thickness of the plate.

3. Six parts are to be plated at one time in a common tank, and an independent power supply is required for each part.

4. The power supply units must be equipped with necessary control and signal features which will make it possible for one operator to handle, simultaneously, six pieces of work, each in a different stage of the plating cycle, without confusion and so far as possible eliminating rejects due to under or over plating.

5. The rectifier units must be close to the tank, and for this reason, minimum floor space is important.

Available power supply in the plant includes 440 volt—60 cycle—3 phase current for main power supply; also 115 volt—60 cycle—single phase current, if required, for signalling or auxiliary circuits.

Basic Equipment Selected:

For the basis of design of the rectifier unit, one of the company's standard 440 volt input selenium rectifier units was selected. This unit has an output capacity of 1800 amperes and

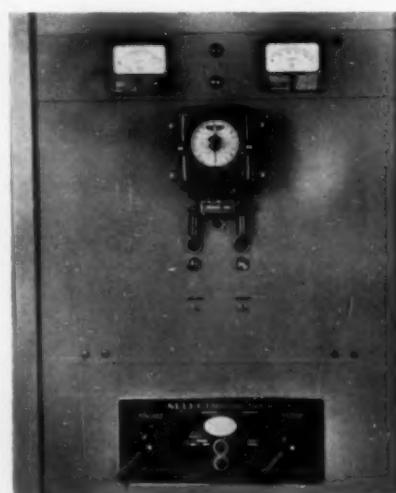
a voltage range of 2 to 12 volts with standard 49 steps of voltage control.

All standard features were retained: voltmeter, ammeter, pilot lamp, monitor lamp and buzzer (visible and audible overload warning), "automatic watchman" (automatic shutdown—if overload warning is ignored), output terminals on either side, base casters for mobility, on-off push button control, provision for remote push button control; also remote pilot and monitor signalling, etc.

This model is of the single unit type incorporating the rectifier, all meters, controls, etc., in one cabinet requiring about 3 x 2 feet floor space.

Special Features:

The photograph shows a special panel incorporated in the unit. On this panel, the major component is an ampere-hour meter internally connected to measure the ampere-hours delivered by the rectifier to the load. This meter is calibrated up to 10,000 ampere-hours.



Photograph of control panel showing voltmeter, ammeter, ampere-hour meter and control switches.

The ampere-hour indicator can be reset by the lower knob on the meter to zero. A second pointer, controlled by the knob projecting through the glass cover, can be preset to any desired ampere-hour value on the scale. When the ampere-hour indicator has progressed from zero to the preset pointer, an auxiliary circuit is closed.

This auxiliary circuit is energized from an external 110 volt source in the plant, and by means of the two panel switches "Signal" and "Shutoff" either or both of the following operations can be provided:

Signal—When this switch is in the "on" position (as indicated by the neon pilot lamp), closure of the ampere-hour meter auxiliary circuit will light a red signal lamp on top of the rectifier. In addition, a terminal board has been provided in the unit to which may be connected a warning bell or any other signal device to operate simultaneously with the red lamp.

Shutoff—When the switch is "on" (indicated by its neon pilot lamp), closure of the ampere-hour meter auxiliary circuit will shut down the rectifier thus stopping further deposit. If the "Signal" switch is also "on", the signal lamp and the external warning signal, if any, will continue to operate after the rectifier has shut down.

Practical Operation:

A typical sequence of operations illustrating the use of the special features is as follows:

1. At start of cycle, set ampere-hour indicator at zero, and preset pointer at 1000 ampere-hours. Set rectifier to desired amperage as indicated on ammeter. Throw "Signal" switch on.

2. When signal indicates 1000 ampere-hours has been reached, increase

preset pointer to 2000 ampere-hours, increase tank voltage to second step.

3. Repeat (2) as required during cycle.

4. For last step in cycle, set pointer to maximum ampere-hours desired, and throw "Shutoff" switch on, as well as "Signal" switch. At completion of plating, rectifier will shut down and signal completion.

Notes:

No special engineering was required to permit operation of six rectifiers, each with separate work, in a common tank. This has been done before, and because of the individual controls and meters, is entirely practical. Individual control over each piece results in greater uniformity of results.

The use of individual units instead of a common power supply eliminates the need for shutting down while loading and unloading six pieces simultaneously—hence the tank is operating at nearly 100% capacity as it is possible to get. The minimum number of pieces in the tank, once it has been loaded, is five—and this minimum occurs only during the time required for the operator to unload and replace one piece.

The ampere-hour meter in conjunction with the "Signal" and "Shutoff" circuits makes operation semi-automatic, and eliminates the need for keeping separate time tables on each piece of work. The operator is able to give full attention to each unit in turn without worrying about the other five.

Patents

Hot Galvanizing

U. S. Pat. 2,286,194. A. F. Bradley, assignor to Northwestern Steel and Wire Co., June 16, 1942. A continuous process for drawing and hot galvanizing wire, including the passage of current through the wire to maintain it at certain desired temperatures throughout the process.

Metal Coating

U. S. Pat. 2,286,333. C. Bowsher, assignor to The Artkraft Sign Co., June 23, 1942. An alloy for coating welds, comprising by weight approximately 7.25 parts bismuth, 12.5 parts tin, $\frac{1}{4}$ part mercury and 79.5 parts lead.

Abrasive Blasting

U. S. Pat. 2,286,754. V. E. Minich, as-

signor to The American Foundry Equipment Co., June 16, 1942. A machine for throwing abrasive at blasting velocities.

Metal Coating

U. S. Pat. 2,287,227. C. Bowsher, assignor to The Artkraft Sign Co., June 23, 1942. An alloy for coating welds, comprising by weight approximately 6.5-22 parts zinc, 7.25 parts bismuth, 12.5 parts tin, $\frac{1}{4}$ part metallic mercury and 57.5-73 parts lead, said alloy having a melting point of less than 850°F. and adapted to be spread when applied as a cold stick to a heated metal surface.

Metal Spraying

U. S. Pat. 2,287,770. F. O. Albertson, assignor to Albertson & Co., Inc., June 30, 1942. A metal spray gun of novel design with adjustable air nozzle.

Nickel Coated Iron

U. S. Pat. 2,289,614. W. A. Wesley & H. Rollason, assignors to The International Nickel Co., Inc., July 14, 1942. A process for producing nickel coated ferrous articles which comprises applying a varnish containing nickel flakes and subjecting the coated articles to heat treatment at 1400°-2100°F. in a non-oxidizing atmosphere, then cold rolling and reheating until a nickel coating is obtained with suitable impermeability.

Electroformed Screen

U. S. Pat. 2,287,122. E. O. Norris, assignor to Edward O. Norris, Inc., June 23, 1942. A method of producing endless strips of screen by electroforming on a cylindrical matrix revolving in the solution.

Electroformed Screen

U. S. Pat. 2,287,123. E. O. Norris, assignor to Edward O. Norris, Inc., June 23, 1942. A method of producing matrices for the production of electroformed screen.

Cleaning Tin

U. S. Pat. 2,285,676. M. Metziger & A. Long, assignors to Blockson Chemical Co., June 9, 1942. An alkaline cleaner for tin which does not attack the surface or form spangles on tin plate comprising a non-caustic alkaline detergent as the essential cleaning constituent, less than 4% of a chromate salt of alkali metal, and an alkali metal silicofluoride up to about 15%.

Example: 1 2
Soda ash 19.5% 44.5%
Trisodium phosphate ... 45% ..
Sodium metasilicate ... 25% 50%
Sodium silicofluoride ... 10% 5%
Sodium dichromate 0.5% 0.5%

Cleaning Magnesium

U. S. Pat. 2,287,049. M. A. Miller, assignor to Aluminum Co. of America, June 23, 1942. A non-etching cleaner for magnesium articles comprising about 1 to 10% sulfuric acid and a total of from about 0.5 to about 15% of at least one soluble aromatic

compound selected from the group consisting of phenol, resorcinol, pyrogallol and gallic acid.

Example:

Sulphuric acid 3% by weight
Phenol 3% by weight
Water 94% by weight
Temp. = Room. Time = 3 min.

Cleaning Magnesium

U. S. Pat. 2,287,050. M. A. Miller, assignor to Aluminum Co. of America, June 23, 1942. A non-etching cleaner for magnesium articles comprising about 1 to 10% sulfuric acid and a total of from about 0.5 to about 15% of at least one aliphatic polybasic acid selected from the group consisting of oxalic, malic, citric and tartaric acids.

Example:

Sulphuric acid 3% by weight
Citric acid 3% by weight
Water 94% by weight
Temp. = Room. Time = 3 min.

Coloring Aluminum

U. S. Pat. 2,285,468. C. J. Slunder, assignor to Aluminum Co. of America, June 9, 1942. A method of producing a white matte finish on aluminum and aluminum base alloys which consists in immersion at 80°-100°F. in a solution containing 10-15% by weight of hydrofluoric acid and 5-15% by weight of ferric chloride, followed by cleaning to remove the products of the reaction from the surface. The article is then reimmersed in the etch for a short period and the discoloration is removed in an acid selected from the group consisting of nitric acid and chromic acid.

Example:

Hydrofluoric acid (48%) 200 cc./l.
Ferric chloride, crystals 150 g./l.
Temp. = 90-100°F. Time 3 min. (Action practically ceases). Wash with water and immerse again for one-half minute. Then wash and remove discoloration in one of the following:

1. Nitric acid	750 g./l.
2. Nitric acid	500 g./l.
Sulfuric acid	170 g./l.
3. Sulfuric acid	175 g./l.
Chromic acid	35 g./l.

Pickling Beryllium Copper

U. S. Pat. 2,284,743. H. C. Kawecki & W. E. Martin, assignors to The Beryllium Corp., June 2, 1942. A pickling solution for removing scale and metal oxides from copper-beryllium alloys consisting of water containing up to 50% by weight of a caustic alkali and up to 10% by weight of an alkali cyanide.

Example:

NaOH 40-50% by wt.
NaCN 5-10% by wt.
Temp. = 80-100°C.

SHOP PROBLEMS

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. The questions this month are answered by G. B. Hogaboom, Jr., Nathaniel Hall, Winslow H. Hartford, and Dr. Walter R. Meyer. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and kept confidential, if desired.

Reanodizing of Machined Surfaces

Baltimore, Md.

Dear Sir:

I would appreciate any information you might be able to give on the relative merits of reanodizing and chromic acid treatment of small surfaces which have been machined since anodizing.

Any discussion as to paint adhesion and corrosion resistance tests on such surfaces, will be helpful.

J. A. K.

Answer: Because of the high electrical resistance of anodic films, the anodizing process possesses nearly perfect throwing power—or ability to produce a film of uniform thickness. Consequently, in reanodizing material where the anodic coating has been removed from some surfaces by machining, there will be low electrical resistance and rapid film formation at those points. The time required for reanodizing will be the same as that needed for an unanodized part, although the current consumption will be somewhat less because of the slower rate of film formation at the previously anodized surface. The reanodized part will be similar to a conventionally anodized part, and the additional film growth on the anodized surfaces will not be injurious.

Chromic acid dips form a satisfactory surface for painting when service requirements are not too severe. The oxide film formed in the chromic acid dip is far thinner than that produced in anodizing, and hence would not be a satisfactory substitute for an anodic coating where prolonged salt spray resistance is required. It is therefore advisable to reanodize if salt spray resistance is specified.

Since both films are oxide coatings, their painting characteristics are similar; the main difference is in the thickness of film and resulting durability and corrosion resistance. Whichever process is used, the grease and dirt resulting from machining operations must be completely removed, preferably by an organic solvent. Strongly alkaline cleaners should be avoided, since they tend to dissolve any existing oxide coating, and attack the metal. If, as is frequently done, it is desired to remove completely the old anodic film prior to reanodizing or other treatment, oxide coating may be removed

without appreciably affecting the base metal by immersing the parts for 5-10 minutes in a boiling solution of the following composition:

Phosphoric acid, 85% (sp. gr. 1.71)	50 lb.
Chromic acid	16.7 "
Water	100 gal.

—Winslow H. Hartford, Research Dept., Mutual Chemical Co. of America, Baltimore, Md.

Hydrogen Embrittlement of Plated Clips

Cleveland, Ohio

"Gentlemen:

We have installed and have been operating for several months now, cadmium plating equipment to finish our 'speed' nuts and 'speed' clips primarily for the aircraft industry.

Our purpose in writing you is that we are having considerable difficulty with the parts that are made of .70 to .80 carbon spring steel, tempered, and then plated, having these parts become brittle in the plating process, and therefore, unsatisfactory for their ultimate use. To eliminate this hydrogen embrittlement, we have gone so far as to bake our product at 350° F. for as long a period of time as 20 hours. It is our thought that perhaps you can give us data regarding methods to relieve the hydrogen embrittlement from plated parts that will assist us in increasing our production. The plated finish that we are required to plate on our spring steel stampings is 0.0005" thick according to aircraft specifications.

Very truly yours,
T. P. Inc."

Answer:

Regarding breaking of cadmium plated clips, your problem has been made unnecessarily difficult by specification of the heavy thickness of cadmium, namely, 0.0005". The amount of hydrogen absorbed during plating by the steel is somewhat proportional to the thickness applied, and in addition, the heavier the coating, the more difficult it is to drive off the hydrogen from the steel inasmuch as it entails a diffusion of the hydrogen through the cadmium plate, and hydrogen does not diffuse readily through cadmium. This accounts for the reason why you have failures even after 20 hours of baking.

In some cases, you may possibly have

the cadmium plate thicker than 0.0005" and in these cases, the hydrogen may not be removed even in 20 hours. First of all, I would try to have the specification lowered to 0.0002", which should be ample for most of the conditions of service.

It would be much safer to have less cadmium and less protection to corrosion than it would be to always have the danger of embrittlement from cadmium plating.

High carbon steel of the order of 0.8 carbon is unfortunately more susceptible to embrittlement than lower carbon steel. It would not help matters by applying a zinc plate inasmuch as zinc is worse than cadmium. In the use of muriatic acid you do not mention whether an inhibitor is being used to reduce hydrogen evolution. I would suggest that one be used. This type material will retard attack upon the spring during removal of scale. I would suggest using 1 volume muriatic acid, diluted with 2 volumes of water, and operating the acid at room temperature.

After pickling, the work should be thoroughly rinsed and given a dip in 3% sodium cyanide followed by a rinse, to inhibit danger from subsequent staining. The springs should then be given a baking for 1 hour at 350° F. Following this bake, they should then be cleaned in an alkaline cleaner, given a short dip in the previously mentioned acid to remove any light oxide formed in the baking, rinsed, cyanide dipped and then cadmium plated. The reason for the baking after pickling is that all of the hydrogen content in the steel after pickling can be easily removed when the cadmium plate is not on the work, whereas if this heat treatment is not done, hydrogen will be in the steel on going into the plating solution, and this hydrogen will have to be diffused through the cadmium plate together with the hydrogen absorbed during plating.

After plating, the spring should be baked at 400° F., for at least five hours, in a furnace.

Careful work has shown that it is more effective to heat in air than oil.—W. R. M.

Cleaning Steel Shot

New York, N. Y.

"Gentlemen:

Please advise the best procedure for the cleaning of steel shot used in tumbling.

These shots have a film of lead and antimony and after boiling them in sodium cyanide and water, they are not cleaned off the film.

L. B. A.

Answer:

For removing a film of lead and antimony from steel shot, an oxidizing agent plus caustic soda should be used. These metals

do not dissolve readily in alkali if oxidizing agents are not present.

We suggest trying a solution of 4 oz. per gal. of caustic soda, to which has been added 1 oz. of 100 volume hydrogen peroxide. The mixture may be used cold or warmed to 120° F. A hot solution of caustic soda and a solid oxidizing agent, such as sodium nitrate or sodium chlorate, will also dissolve the tin and antimony.—W. R. M.

Gold Plating Lead-base Alloys

Toronto 2, Canada

"Gentlemen:

On account of priorities, we have had to stop the use of Britannia metal and all tin-base alloys, which we have previously used in the manufacture of our costume jewelry. We are now using a lead-base alloy and are coming to you for advice and suggestions with reference to the finishing of this type of metal.

We would appreciate if you could give us a step by step technique so that we can obtain a highly polished gold and rhodium finish.

Yours very truly,
B-B & Co., Ltd."

Answer:

No specific information can be given on the polishing of your lead base alloys, although your experience with tin base alloys will show you that high wheel speeds are to be avoided. Also, higher grease content compositions will be required to obtain color. Consult composition manufacturers.

The cleaning must be done so that no attack of the metal occurs. This requires a mild cleaner, operated not over 180° F., and a short cleaning time. Under these conditions, the work must be as clean as possible before going in to the cleaner. Removal of packed in composition by solvents, and hand wiping is therefore necessary.

After cleaning, rinse, dip in 10% hydrochloric acid, rinse, examine for water chloride. If water breaks exist, go back for a light clean, then rinse, acid dip and examine again. Luster on the work should not be attacked nor should a smut be produced. If these defects have been produced, correct them before plating.

Follow the acid dip and rinse by a dip in 4 oz./gal. sodium cyanide.

For gold plating use a solution as on page 58 of the 1942 Plating & Finishing Guidebook:

Potassium gold cyanide	1/2 oz.
Potassium cyanide	3/4 "
Water	1 gal.

Gold plating direct on a lead base alloy would normally not be considered good practice, it being generally desirable to copper plate and buff before gold plating to obtain a good finish. Neither copper, nor rhodium plating are now permitted in the U. S. on non-defense work.—G. B. H., Jr.

Harder Zinc Deposit

Atlanta, Ga.

"Gentlemen:

We would appreciate your advising us if you know of a metal which we could add to

zinc to harden it so that it would withstand buffing and which alloy would not have to carry a priority to use.

The zinc solution works fine but when we try to get a polished buff finish on same, we find it will not stand the pressure of a buff.

Yours very truly,
H. C. S."

Answer:

In order to overcome your trouble, a bright zinc plating solution can be considered. Many of the plating supply houses advertising in METAL FINISHING magazine have bright zinc plating processes.

The advantage of a bright zinc deposit would be that little or no polishing of the deposit would be required.

With your present deposit, you can scratch brush wet before buffing, thus cutting down much of the roughness without cutting through. On the coloring, use a soft wheel, not a sewed buff, with a greasy lime composition.

Putting a better finish on the base metal, and plating a heavier deposit, will also help. Check the clarity and composition of the solution so that as smooth a deposit as possible is obtained.—G. B. H., Jr.

Non-tarnishing Silver

Dallas, Texas

"Gentlemen:

Have you any information on 'Silbright' and non-tarnish silver? We are very much interested in these and would appreciate any information that you may send us.

Very truly yours,
P. P. Co."

Answer:

We have no information on "Silbright" nor is this name listed in the Trade Names Index published by the Special Libraries Association.

On the subject of non-tarnishing silver, much has been written but to date there has been nothing practical to which to point. It is not possible to put more than 7.5% alloying metal with silver, and still call it "Sterling" because sterling must contain at least 92.5% silver. To date, alloys of silver containing no more than 7.5% alloying elements, have not been found that are free from tarnish attack. Cadmium-silver alloys have shown most promise, but not in contact with foods because cadmium is poisonous.

H. Krause says tarnish of silver can be delayed by making the silver cathode in chromic acid solution, or in a solution of chromates plus sulfuric, at room temperature or higher. Use 5 to 7 volts for 1 to 5 minutes.—G. B. H., Jr.

Streaky Silver Plate

Richmond Hill, N. Y. C.

"Gentlemen:

We seem to be having trouble with our silver plating coming out streaky and brassy in spots. We are enclosing samples of our silver solution and also our tap water. Kindly analyze these solutions and let us know where the trouble may be.

The silver plating is done in our plant.

and is used for plating brass scales and brass dials.

Very truly yours,
M. I. Co."

Answer:

The analysis of the silver solution is as follows:

Metallic silver	0.34 troy oz. gal.
Free cyanide	4.9 av. oz./gal.
Carbonates	6.6 "

This solution is in very poor condition with respect to metal content, and in addition is contaminated with an appreciable amount of copper. It could be used as a combination strike and plating solution, if only flash deposits are required by first striking at 6 volts and then cutting the voltage down to about 1 volt after a few seconds.

For heavy plating, the metal content should be at least 2½ oz./gal. which would require the addition of at least 3 oz./gal. of silver cyanide. Since a new solution would require 3½ oz./gal., it is recommended that a new solution be made up according to the formula in the 1942 Plating & Finishing Guidebook.

The streaks and brassy spots may be partly due to the poor condition of the solution and in great part to improper preparation of the work before plating. The work should be cleaned in a good alkaline cleaner, rinsed, cyanide dipped, rinsed, silver struck and then transferred directly to the plating solution.—G. B. H., Jr.

Thiourea-nitrate Silver Plating Solutions

West Lynn, Mass.

"Gentlemen:

In your 1941 'Plating and Finishing Guidebook' reference is made to thiocyanate and thiourea-nitrate silver plating solutions.

Would you be good enough to give us references on these solutions or copies of them if you have them on file.

Thank you.

Sincerely yours,
T. G. W."

Answer:

In reference to your letter of April 30th, we do not recommend the use of the thiocyanate or the thiourea solutions mentioned in your letter. Thiourea-nitrate baths are described in Zeitschrift für Elektrochemie, Volume 40, p. 302, 1934, and in U. S. Patent No. 1,903,806.

The solution that we recommend for rapid plating and for general use is that suggested by Donald Wood and described as the No. III solution on page 78 of the 1942 "Plating & Finishing Guidebook". It is also described on page 186 of the April 1942 issue of METAL FINISHING.

—W. R. M.

Chromium Plating Taps

Colrain, Mass.

"Gentlemen:

I am interested in learning the method for chromium plating taps and dies.

Are all parts of the tap and die covered with varnish excepting the threads and are

the threads plated over-size and then by some process cut back to the right size?

I cannot understand how the threads can be plated to the right size. My theory is that the cutting edge would become rough.

Yours very truly,
H. C."

Answer:

To avoid the dangers you mention of roughness, and to avoid grinding oversize plating which is quite a job, the better practice is to apply only a light chromium deposit.

Use a solution such as given on page 295 of the June 1941 issue of *METAL FINISHING* in an article by A. Mankowich:

Chromic acid 33 oz. per gal.
Sulfuric acid 0.33 " "

Operating at 130° F., 400 amperes per sq. ft.

For plating taps and dies, a light deposit obtained in 10 or 15 minutes plating time, will add appreciable wear resistance to the tools, and no grinding or loss of dimension of the tool need occur.

When the light chromium deposit has been worn through use, strip off the remaining chromium in a solution of 16 oz./gal. of caustic soda, using reverse current at 6 volts. The tool can then be cleaned up by giving a light polishing with aluminum oxide rouge, cleaned in the usual way, and given another light chromium plate.—G. B. H., Jr.

Faulty Nickel Solution

Denver, Colo.

"Gentlemen:

We are mailing you a sample of our nickel plating solution. We know very little about this solution, therefore, we would appreciate any information for corrections or additions that we should make.

Very truly yours,
H. I. Co."

Answer:

The analysis of the solution shows:

Nickel 3.0 oz./gal.
Chloride as ammonium chloride 2.5 "
Boric acid 2.5 "
pH 6.8 "

The pH is much too high and its correction should relieve much of the trouble you are having.

To approximately correct the pH (desired value is 5.8), add 9 fl. oz. of sulfuric acid to the tank.

Before making this addition, remove all mud that may now be at the bottom.

To overcome pitting, add hydrogen peroxide in small doses, about ½ fl. oz. of the 100 volume strength peroxide to your tank, before each week-end.

Also add to the solution: 1 lb. of ammonium chloride and 5 lb. of boric acid. The pH should be checked after all these adjustments.

If dark deposits are obtained after the additions, electrolyze on dummies at 5 amp. per sq. foot (of dummy area) for several hours. The dummies can be sheets of steel.

—G. B. H., Jr.

Silver Plating Stainless Steel

Brooklyn, N. Y.

"Gentlemen:

Will you please send me the best method you have for plating silver upon steel and stainless steel.

Thanking you, I am

Very truly yours,
J. L."

Answer:

For plating on steel, the use of two strikes is advisable to insure good adherence especially if heavy deposits are to be applied.

First strike:

Silver cyanide 0.2 oz./gal.
Copper carbonate 2.0 "
Potassium cyanide 9.0 "

Second strike:

Silver cyanide 0.8 oz./gal.
Potassium cyanide 9.0 "

Silver plate:

Silver cyanide 4.4 oz./gal.
Potassium cyanide 5.0 "
Potassium carbonate 5.0 "

For plating silver upon stainless steel, first strike in a nickel chloride solution as described by Donald Wood in the July 1938 issue of *Metal Industry* (now *METAL FINISHING*).

Nickel chloride 32 oz./gal.
Hydrochloric acid 16 fl. oz./gal.
Use 6 volts.

Then go into the second silver strike above.
—G. B. H., Jr.

Silver Specification for Flatware

East Syracuse, N. Y.

"Gentlemen:

According to Federal Specification RRT 56, dated August 22, 1941, steel flatware, silver plated, is supposed to stand a 24-hour salt spray test. Will you kindly advise us how much silver, in your opinion, we should plate on steel in order to stand this 24 hour salt spray test?

Yours truly,
B. Mfg. Co."

Answer:

The specification you mention has been amended by an Emergency Specification June 10th, 1942, which sets up 2 grades of silver plated steel flat ware.

Grade A calls for a thickness of 0.001" of silver.

Grade B calls for a thickness of 0.0005" of silver.

Orders will specify which grade is to be furnished.

Recovery of Silver

Baltimore, Md.

"Gentlemen:

We have about 150 gallons of a cyanide silver plating solution containing about 0.65 oz. of silver per gallon. This solution has become contaminated with nickel and we would like to recover the silver and scrap

the solution. Do you know of any way this can be accomplished in an economical way?

Yours very truly,
S. P. W."

Answer:

Several chemical precipitation methods are possible, but the easiest procedure is to simply plate out the metal on steel cathodes. Use insoluble (steel or carbon) anodes.

If the solution contains much nickel, the silver will deposit out in a spongy form. To prevent loss of particles dropping off the cathodes, remove the cathodes occasionally and brush loose material off, or transfer the solution to clean steel drums.

The latter procedure would be preferable, as then the drums could be used as the anode, and any material dropping to the bottom can be recovered. In the meantime the plating tank can be cleaned out and put back into service.

The length of time required to plate out the silver will depend on the cathode surface used. On the basis of 1 square foot of cathode surface, to which 4 amperes are applied, about ½ troy ounce of silver will be taken out per hour on basis of 100% efficiency. To allow for lower efficiency, and other losses, increase the time required.

Chemical methods for recovering the silver include adding zinc shavings, or mossy zinc, on which the silver will precipitate. The excess zinc is then removed by treating with hydrochloric acid, leaving a silver mud.

Perhaps the easiest procedure of all is to send the solution to a refiner after evaporating it down to a small volume.

—G. B. H., Jr.

Measuring Silver Thickness

Brooklyn, N. Y.

"Gentlemen:

Kindly advise us at once whether there is an instrument on the market which measures the thickness of silver plate on brass or copper after the item is plated, or if not, whether there is a formula for spot testing such an item.

Very truly yours,
C. Silver Co."

Answer:

We know of no instrument on the market suitable for measuring silver plate thickness on brass or copper.

An instrument called the Magne-Gage could be used if the silver plate were over steel, as this instrument depends on having a magnetic material in either the base or the plate for its operation.

The "Jet method" has been suggested for the determination of silver thickness. A small stream of a solution of 250 grams potassium iodide and 7.44 grams of iodine per liter of water, is allowed to flow on the plated surface. The rate at which the silver is dissolved is affected by the temperature, but at 18° C., the rate is 0.0001" in 6.6 seconds. Other details and references are given on page 123 of the 1942 Plating & Finishing Guidebook.

The chord method described on page 120 of the Guidebook may be used as well as viewing a cross section under the microscope.—G. B. H., Jr.

THIS IS WASHINGTON—

By George W. Grupp

METAL FINISHING's Washington Correspondent

Electroplating Committee Meets Soon

Sometime in September, the second meeting of the War Production Board's Electroplating Industry Advisory Committee is expected to take place for the purpose of considering a revision of Order L-110. The functions of this committee are to give a cross section point of view of the electroplating industry in the United States and to make suggestions to the War Production Board's Electroplating Section which will be helpful to the industry as a whole and aid in winning this war.

Nelson Will Strike Back

Chairman Donald M. Nelson of the War Production Board is expected to strike back at those who have criticized the functioning of the WPB. He is expected to use the full powers which were given to him by Executive Order. This should mean that another shake-up is in the making; and there will be a number of casualties.

Profit Ceiling Proposed

Senator Walter George of Georgia, Chairman of the Senate Finance Committee, is planning to add an amendment to the new tax bill which will place a profit ceiling of 5 to 6 per cent on all prime contractors and subcontractors doing work for the Army, Maritime Commission, and Navy.

Airplane Engine Forgings Seized

The War Production Board's seizure of nearly 800 tons of airplane engine forgings which were prepared for shipment to France before the outbreak of war has placed into the hands of the United States, a considerable amount of critical materials of which more than one half contains at least 3 per cent nickel.

Alien Property Seized

Alien Property Custodian Leo T. Crowley on August 18, 1942 seized the holdings of Leonardi Cerini, an Italian, in R. A. C. E. Inc., of Cleveland, Ohio—a company engaged in the design and manufacture of chemical equipment.

Aluminum Prices

All kinds of secondary aluminum ingots and practically all grades of aluminum scrap were included in Aluminum Revised Price Schedule No. 2, as amended, dated August 14, 1942. Segregated plant aluminum scrap, depending on the grade, ranges from 7½ cents to 10½ cents per pound; mixed plant aluminum scrap prices range from 6½ to 8½ cents per pound; and obsolete aluminum scrap prices range from 7 cents to 10 cents a pound.

Aluminum Plant Location Abandoned

The foundation borings for an aluminum forging plant on the Hardinge site near Pittston, Pennsylvania reveal the existence of quicksand strata at levels ranging from 15 to 60 feet below the surface. For this reason the Aluminum and Magnesium Branch and the Plant Site Board of the War Production Board have abandoned the site.

Antimony Prices

General Maximum Price Regulation Amendment 16 to Supplementary Regulation No. 1 which was issued on July 20, 1942 exempts from the General Maximum Price

Regulation such materials as antimony, residues, slags, skimmings and drosses.

Antimonial Lead Prices

Amendment No. 5 to Revised Price Schedule No. 70 under date of July 22, 1942 extends the provisions of the original Order to include with lead scrap materials, secondary lead and battery lead scrap both primary and secondary antimonial lead.

Antimony Restrictions Eased

Permission was granted in the August 8, 1942 Amendment No. 1 to General Preference Order M-112 as amended July 11, 1942 to increase the antimony content of alloys for battery grids from 7½ per cent by weight to 12 per cent, providing only secondary antimonial lead is used. This will increase the life of automotive batteries.

Army's Price Adjustment Sections

The Army Corps of Engineers, Service of Supply, created on August 11, 1942 two Price Adjustment Sections to renegotiate contracts with prime and subcontractors. The establishment of these Price Adjustment Sections does not stop contracting officers from making adjustments of prices and fees in individual contracts containing provisions for redetermination according to some specified formula. Neither does it ban these contracting officers from reconsidering individual contracts by voluntary renegotiation.

Army Revises Prohibited List

The Army's revised "List of Prohibited Items for Construction Work" in the building of barracks and buildings continues to be severe on the use of copper, zinc, aluminum, and lead. Nickel, magnesium and chromium are practically barred from use. Copper flashing for walls and roofs is replaced by flashing of asphalt-coated steel. Brass for bathroom fixtures has almost disappeared.

Blackplate May Be Used

The use of blackplate for cans was limited to packing of such commodities as abrasive and grinding compounds, cements and dressings, solder and boiler sealing compounds, liquid glues, dry solvents, sodium silicate, benzol, paints, resin-emulsion water paints and varnish by Conservation Order M-136 issued on July 22, 1942.

Brass Alloy Prices

Maximum Price Regulation No. 202, dated August 13, 1942, has reduced the average selling price of brass and bronze alloy ingots about 1.20 cents per pound below the March, 1942 level.

Brass Mill Prices

Order No. 46 under Section 1499.3 (b) of the General Maximum Price Regulation, dated July 28, 1942, fixes the formula which brass mills may use in determining maximum prices on items which cannot be ascertained under Section 1499.2. "This Order provides that a brass mill may determine the maximum price for such items by applying

the same pricing formula or method of calculating prices which it would have used on March 31, 1942", Price Administrator Henderson said.

**Building
Repair
Regulation
Amended**

Since July 23, 1942 it has been permissible to repair non-residential damaged or destroyed property if its immediate restoration is "necessary for the prosecution of the war or to protect public health or safety", according to Amendment No. 2 of Conservation Order L-41. Application for authorization must be made on Form PD-200.

**Carbon
Tetrachloride
Surplus**

General Preference Order M-41 as amended on May 2, 1942. The Amendment doubles the quantity allowable to users with B-2 ratings up to and including September 30, 1942.

**Razor & Razor
Blade
Restrictions**

Restrictions on the sale of safety razors and razor blades by jobbers and manufacturers imposed by Limitation Order L-72-a has been revoked by the WPB Division of Industry Operations.

**Resales to
Retailers**

The Division of Industry Operations has extended Priorities Regulation No. 10 to distributors who buy for resale to retailers. This Amendment applies to all sales in excess of fifteen dollars. Under this extension "industrial and mill suppliers, warehouses and other businesses performing similar functions for industry shall not be deemed retailers."

**Service
Charges**

The Office of Price Administration established price ceilings for transportation services of carriers other than common carriers, for commercial storage and warehouse services, for terminal services, for forwarding, consolidating and distributing services, and for packing, crating, marking and labelling services.

**Smaller War
Plants
Corporation**

Congress for the purpose of bringing additional smaller manufacturing plants into war production. This corporation will aim to keep the making of relatively simple war items within the bounds of smaller manufacturing plants, to extend subcontracting through pools, and to help convert small plants into essential civilian production.

**Venetian
Blinds**

Manufacturers of venetian blinds, according to July 11, 1942 Amendment No. 3 of General Limitation Order L-62, are permitted to assemble until this forthcoming September all fabricated metal parts they had on hand on March 20, 1942 provided the parts do not contain more than 2% of aluminum.

**Preference
Ratings
Re-rated**

Priorities Regulation No. 12 of June 27, 1942, New ratings such as AAA, AA-1 and AA-2 are higher than A-1-a ratings. The purpose of this re-rating procedure is to provide greater flexibility in assigning preference ratings. All outstanding ratings of AA have been automatically changed to AA-2.

**PRP Quarterly
Certificates**

Interpretation No. 2 on Priorities Regulation No. 11 issued on July 13, 1942 makes it clear that manufacturers operating under the Production Requirements Plan may request their suppliers to retain their orders on their books for future delivery, if they exceeded the amount author-

ized by their PRP quarterly certificates. If this is not done then they must either cancel or reduce their outstanding purchase orders.

**Price
Regulation
Exemption**

Price Administrator Leon Henderson has ruled that purchases not exceeding \$1,000 in value by the United States Government for immediate delivery for an emergency purpose are excluded from the General Maximum Price Regulation.

**Caustic Soda
Inventory
Regulation**

Industrial users of caustic soda and soda ash were granted unlimited inventory storage privileges on August 3, 1942 by the issuance of Amendment No. 3 to General Inventory Order M-161.

**Chemical & Drug
Distributors
Licensed**

Supplementary Order No. 11 issued by the Office of Price Administration on August 6, 1942 placed under license all distributors of chemicals and drugs covered by specific price regulations. Retailers were excluded from this licensing order.

**Chemical
Experts
Appointed**

A committee of distinguished American chemists and chemical engineers were appointed to advise the War Production Board on technical processes. The committee, which is headed by Dr. Donald B. Keyes, head consultant to the Chemical Branch of WPB and professor of chemical engineering at the University of Illinois, consists of Dr. Marston T. Bogart of Columbia University; Dr. Joel H. Hildebrand of the University of California; Dr. S. C. Lind of the University of Minnesota; Dr. Frank C. Whitmore of Pennsylvania State College; Dr. Gustavus J. Esselen of Gustavus J. Esselen Incorporated; Carl S. Miner of Miner Laboratories of Chicago, Illinois; Dr. Foster D. Snell of Foster D. Snell Incorporated of New York City; Charles O. Brown a New York City consulting engineer; Dr. Charles R. Downs of Weiss & Downs Incorporated of New York City; Sidney D. Kirkpatrick—editor of Chemical and Metallurgical Engineering; and Dr. Fred H. Rhodes of Cornell University.

**Chemical
Reclamation
Program**

Millions of pounds of essential chemicals are to be salvaged as a result of a campaign for the recovery and reclamation of wasted spray paints. In this salvaging program large quantities of pigments, phthalic anhydride, glycerol phthalate resin, alkyd resins, nitrocellulose and plasticizers will be reclaimed.

**Chemicals
Transportation
Advisory
Committee**

Joseph B. Eastman, Director of the Office of Defense Transportation appointed a Chemicals Transportation Advisory Committee which consists of John Keeler of Koppers Company of Pittsburgh, Pennsylvania; H. M. Mayhew of Mathieson Alkali Works of New York City; J. W. Brown of E. I. DuPont de Nemours & Company of Wilmington, Delaware; S. G. Moore of Pittsburgh Glass Company of Pittsburgh, Pennsylvania; C. H. Beard of Carbide and Carbon Chemicals Corporation of New York City; N. B. Chapin of Solvay Process Company of New York City; J. C. Sloss of General Chemical Company of New York City; and A. V. Bourque of the Office of Defense Transportation.

**Contract
Adjustment
Policies**

The Army, Navy, and Maritime Commission Price Adjustment Boards have announced these fundamental policies which will govern their negotiation of contracts: "1. Excessive and unreasonable profits should be eliminated or recaptured. 2. Reasonable profits should be allowed to encourage an uninterrupted, efficient and maximum production of war goods on a low cost basis."

Chlorinated Paraffin Allocation Control

M-189 dated August 10, 1942. Producers must schedule their deliveries on Form PD-618 on the 15th of each month.

Coal Distribution

Adequate operating margins were provided on July 27, 1942 by the issuance of Amendment No. 11 to Revised Price Schedule No. 120 for the distribution of "smelting coal"—a special purpose coal produced in small quantities and used mainly for heating metals.

Copper Carload Lot Prices

The maximum price for electrolytic, lake or other forms of refined copper in the shape of wire bars or ingots in carload lots at Connecticut Valley points was set at 12 cents a pound by Amendment No. 2 to Revised Price Schedule 15 under date of July 27, 1942. Refiners and producers are allowed to charge 12½ cents per pound f.o.b. on less than carload lots. Others are permitted to sell LCL lots by adding "to delivered costs premiums ranging from ½ to 2 cents a pound" depending upon the size of the shipment.

Copper Banned

The use of copper and copper base alloy for building construction was forbidden, except by special permission, by Conservation Order M-9-c-4 issued on July 22, 1942.

Copper List Extended

A number of items such as radio and communication equipment, insect screening, lamps and accessories, shells and caps for electric sockets, and locks and latches have been added to the "Military Exemption List" in Copper Conservation Order M-9-c under Amendment No. 4 issued on July 30, 1942.

Copper Production Labor Problems

The War Production Board claims that the domestic copper production could have been 5,000 tons greater during July, 1942 if sufficient labor had been available. The Copper Industry Advisory Committee reported to Harry O. King, Chief of the WPB Copper Branch, that the Selective Service had taken as high as twenty per cent of the labor force in some mines. And on top of that they revealed that they had to compete with the attractive wages which were offered to men by the shipbuilding and aircraft industries. Major General Louis H. Hershey, Director of the Selective Service, told the committee that it is the intention of the Service to defer all essential employees of copper mines; and Brigadier General Frank J. McSherry, Director of Operations, War Manpower Commission, urged the mine operators to take advantage of the services of the United States Employment Service.

Copper Ratings Raised

Preference Rating Orders P-129 and P-130, dated July 28, 1942 raised the ratings of copper from A-3 to A-1-j for telephone, telegraph, cable and radio companies for operating, construction, maintenance and repair work.

Corundum Industry Committee

R. J. Lund of the Miscellaneous Minerals Branch of the WPB heads the Corundum Industry Advisory Committee which consists of purchasing manager George P. Brockway of the American Optical Company of Southbridge, Massachusetts; vice-president Sydney Hermant of Imperial Optical Company of Toronto, Ontario, Canada; president Louis M. Fuller of the American Abrasive Company of Westfield, Massachusetts; director of purchases J. E. Hansen of Bausch & Lomb Optical Company of Rochester, New York; and president S. Preisman of Renaud Optical Company of Webster, Massachusetts.

The supply of chlorinated paraffin, which is used entirely by the Army, Navy and Maritime Commission, was placed under complete allocation control by General Preference Order

Core Oil Prices

Price Administrator Leon Henderson on July 22, 1942 in Amendment 17 to Supplementary Regulation No. 1 excepted core oils and core washing oils from the General Maximum Price Regulation.

Copper Scrap Prices

The correction to Amendment No. 1 issued August 15, 1942 to Revised Copper Scrap and copper alloy scrap Price Schedule No. 20 as amended, provides that the price shall be 8.75c a pound for No. 2 wire; and that the price of 8.65 cents per pound shall apply to mixed heavy copper scrap. These prices apply to consumers of from 5,000 to 40,000 pounds of No. 2 copper wire and mixed heavy copper scrap.

Export Order Changes

General Exports Order M-148 Amendment No. 2 issued on July 29, 1942 adds to the 1942 third quarter American preference list such commodities as mercury, platinum, zinc, bauxite, beryl and beryllium. Among the commodities taken from the list are chromium, cobalt (oxide), molybdenum wire and caustic soda.

Fair Employment Practice Committee

The Committee of Fair Employment Practice which was created by Executive Order 8802 on June 25, 1942 to investigate complaints of discrimination in defense employment because of race, creed, color or national origin, which consists of Dr. Malcolm S. MacLean, Mark Ethridge, David Sarnoff, William Green, Philip Murray, Earl Dickerson and Milton Webster, was transferred on July 30, 1942 by President Roosevelt from the War Production Board to the War Manpower Commission.

Foreign Trade Advertising

About 500 United States manufacturers and business firms interested in foreign trade have been asked by the Office of the Coordinator of Inter-American Affairs that they continue their advertising in the American Republics for the purpose of maintaining their good-will and to pave the way for postwar trade.

Foundries Must Give Proof

Foundries and ingot makers must give proof that they are entitled to receive delivery of refined copper, alloy ingots or copper scrap according to August 7, 1942 Amendment No. 1 to Supplementary Order M-9-b as amended August 3, 1942. The buyer of copper alloy ingot, copper alloy scrap or copper scrap must attach to his order a certification with his allocation certificate number. Foundries and ingot makers authorized to receive deliveries of refined copper must surrender their allocation certificates to dealers at the time of placing their orders, and if an order is placed with a refiner, then the refiner must endorse the certificate specifying the amount of refined copper he delivered.

Frozen Inventories Freed

The issuance on August 7, 1942 of Amendment 5 to Conservation Order M-9-c as amended May 7, 1942 curtailing the use of copper in certain items provides that clothing manufacturers are now permitted to affix to clothing, copper and copper plated insignia and costume jewelry which were frozen in inventory by the original Order. The amendment also provides that manufacturers of household gas stoves are prohibited from such production if the valves contain more than one half ounce of copper base alloy and if their control valves contain more than one and one half ounces of this alloy. All lanterns and lantern parts of copper have been banned; and copper bushings, screws, washers and wire acquired prior to February 28, 1942 may be used to complete machinery not on Lists A and A1 of the original order if they contain less than 5 per cent of the total weight of article.

**Functional
Replacement
Parts
Inventories**

supply of functional replacement parts for machinery and equipment costing in excess of \$500. All materials subject to OPA rationing are exempt from the original order.

**General Grant
Tanks**

Elmer Davis, Director, Office of War Information, revealed on August 9, 1942 that one General Grant tank requires among other things 600 pounds of copper, over 500 pounds of chromium, and more than 600 pounds of aluminum, lead, manganese and zinc.

**Guaranteed
Loans**

During the period beginning March 26, 1942 and ending July 25, 1942 the Army, Navy and Maritime Commission have guaranteed over 800 loans made by Federal Reserve Banks to war production industries the War Production Board announced. These loans ranged from \$400 to \$40,000,000. Nearly 60 per cent of the total \$450,000,000 consists of loans for amounts less than \$100,000 each.

**Hairpin &
Bobbin
Production**

Manufacturers of metal hairpins and bobbins have been granted permission to continue at the same rate as effective April 25, 1942 up to September 15, 1942 according to Amendment No. 1 to Order L-104 issued on August 8, 1942.

**Import
Priorities**

The War Production Board has placed on the import emergency shipping priorities list such commodities as abrasives, arsenic acid, antimony, asbestos, bauxite, beryllium ore, bismuth metal and compounds, brass scrap, cadmium metal and flue dust, crude calcium tartate, cobalt in all forms, columbium ore and concentrates, copper in all forms, corundum ore, cresylic acids, emery ore, ferro-nickel, flake graphite, ilmenite sand, iridium, lead in all forms, mercury ore (cinnabar), mercury (quicksilver), nickel in all forms, tung and other oils, platinum in all forms, rhodium, monazite sand, shellac and button lac, tin in all forms, tungsten in all forms, uranium ore, vanadium in all forms, and zinc in all forms.

**Industrial
Machinery
Branch
Dissolved**

Director General for Operations Amory Houghton of the WPB has dissolved the Special Industrial Machinery Branch. The general restrictions on the distribution of industrial machinery imposed by Limitation Order L-83 will now be enforced by A. E. Collins of the WPB Appeals Branch.

**International
Appliance
Corporation**

Because of their illegal use of critically needed nickel in plating electric broilers for non-essential purposes, the International Appliance Corporation of Brooklyn, New York has been denied priority assistance until October 6, 1942.

**Kanzler
Has New Post**

Ernest Kanzler who has completed his job of converting the automotive industry into war production has been appointed Deputy Chairman of the Program Progress Committee of the WPB. In this new position Mr. Kanzler will have the responsibility of knowing at all times when and where production is falling behind, and it will be his duty to discover causes for delay and suggest remedies.

**Lead Order
Revoked**

Order M-38-j was revoked by the Director General for Operations of the WPB because the current lead production is in excess of demand. The monthly lead pool may be restored at anytime in the future when needed.

Distributors and wholesalers who are subject to Suppliers Inventory Limitation Order L-53, by the issuance of Exemption 6 on July 22, 1942, are now permitted to carry six months

**Lead and Zinc
Mines**

will be brought into production with the aid of sensitive instruments developed by the Bureau's engineers. "These instruments," Dr. Sayres states, "by amplifying and recording subaudible noises that indicate pressure zones in rock and warn of impending falls of ground in workings, make it possible to receive with relative safety zinc and lead ore now tied up in old mine pillars that have been left standing to support the roof during earlier mining operations."

**Lead Bullet
Rod Prices**

Maximum Price Regulation No. 199, issued on August 10, 1942, covered lead bullet rod. The regulation sets the maximum price at 1.10 cents per pound, f.o.b. producer's plant, above the producer's cost of required ingredients. This conversion charge was established to increase production and to lower manufacturing costs through increased volume.

**Metal
Furniture
Banned**

The Services of Supply of the War Department canceled all orders for metal office furniture not three fourths fabricated by August 10, 1942. Henceforth no metal office furniture will be bought by the Army for the duration of the war.

**Metal Parts
Limited to
30 Per Cent**

The metal parts or units for blank books, loose-leaf books, binders or covers have been limited to 30 per cent of the 1941 consumption by General Limitation Order L-188 issued on August 4, 1942.

**Mercury
Restrictions**

The August 5, 1942 Amendments to Mercury Conservation Order M-78 place restrictions on redistilling of mercury within the meaning of the term "processing". Exceptions to the restrictions of the original Order now includes "deliveries to laboratories for specific purposes."

**Military
Insignia**

General Limitation Order L-131 dated July 20, 1942 restricted the use of critical materials in the manufacture of military officers insignia. The Order restricts the use of copper base alloys containing more than 65 per cent by weight of copper in findings or fasteners, and not more than 85 per cent copper by weight in insignia fronts. The order also places restrictions on the use of aluminum, magnesium, nickel, nickel silver, tin, cadmium, rhodium and chromium in the making of military insignia.

**Molybdenum
Regulations
Amended**

Molybdenum may be melted by specific authorization of Director General for Operations as ruled in Amendment 1 to General Preference Order M-110 issued on August 8, 1942 or according to approved melting schedules as provided in an earlier regulation known as Order M-21-a. This action places molybdenum under the same restrictions as vanadium.

**National
Roster**

The War Manpower Commission which has compiled the country's largest registration of technically trained persons, known as the National Roster of Scientific and Professional Personnel, will soon announce to American industry where and how it can secure chemists, engineers and metallurgists and other professional and scientifically trained men.

**New Goods
Pricing Methods**

Manufacturers of such commodities as plumbing fixtures, commercial kitchen equipment, lamps, silverware, jewelry and household accessories should familiarize themselves with Maximum Price Regulation 188 issued on July 29, 1942. This regulation provides two methods of pricing all new goods introduced since April 1, 1942.

Nickel Anode Prices

The maximum prices of new and partly used nickel anodes between nickel platers and the Metals Reserve Company were established by Order No. 37 under Section 1499.3 (b) of the General Maximum Price Regulation dated July 22, 1942. And Order 56, issued August 12, 1942, which applies to the general trade, provides that the maximum price for new nickel anodes is 46 cents per pound (weight without hooks) f.o.b. and 43 cents per pound for partly used anodes.

Non-Ferrous Foundries

The Copper Branch of WPB has revealed that non-ferrous foundries need not file Form FD-25A as provided in Priorities Regulation No. 11 if the metals they desire to buy for processing do not total an amount in excess of \$5,000 per calendar quarter.

Non-Ferrous Preference Ratings

which provides that A-1-a ratings may be applied to non-ferrous metals used as operating supplies in the maintenance and repair of iron and steel mills.

Operating Supplies Inventories

Certificates by the Army, Navy and Maritime Commission and other war agencies are permitted to use this rating within specified limits for the obtaining of operating supplies and to replace materials in inventory.

Price Conformation Statements

Price Administrator Leon Henderson has ruled that every invoice does not have to be accompanied by a sworn statement that the price charged conformed with the OPA regulations.

Price Relief

Government and Lend-Lease contractors and subcontractors for machines and parts and machinery services are no longer required to get temporary permits to charge higher prices pending decisions on their applications for price relief according to Amendment 1 to Maximum Price Regulation 136 as amended.

Priorities Regulation No. 12 Interpretation

Interpretation No. 2 of General Preference Order E-1-b on the production and delivery of machine tools. Interpretation No. 3 of this Order, issued on July 30, 1942, provides that applications for higher ratings on machine tools for a service purchaser who has an urgency standing does not change in any way the date of delivery of the tools. Delivery will still be determined solely by the urgency standing and the required delivery date.

Priority Regulations in Force

On August 3, 1942 there were in effect 169 "M" orders creating industry-wide materials controls, 42 "P" orders giving limited blanket ratings for materials, 6 "E" orders giving production preference to war production equipment, 121 "L" orders limiting the production of materials, 37 suspension orders issued to violators of regulations and orders, 14 priority regulations, and 6 WPB directives.

Publishers' Zinc Plate Regulation

In a short time details will be announced by the War Production Board on the segregation of publishers' zinc plates and their remelting for re-use by the publishing industry. A. I. Henderson,

Deputy Director General for Industry Operations feels that the conservation of zinc is necessary because of the great demand for this metal for military purposes.

Priorities

Regulation No. 12 Amended

Priorities Regulation No. 12 as amended August 10, 1942 orders new procedures for applying the higher preference ratings. Under the amended form reratings have been extended to operating supplies up to 10 per cent of the value of material processed; the methods of rerating have been simplified; the officials of the armed services may now use rerating directions in the PD-4X series; a distinction has been made between a "fixed production schedule" and a "production schedule"; a new procedure is now employed in applying for rerating by companies operating under the Production Requirement Plan.

Silver Doubts

The United States Treasury seems to have its doubts about the availability of silver for silverware, jewelry and other non-essentials for the duration of the war. Priority orders have banned non-war users from obtaining imported silver which costs 45 cents an ounce. And since domestic silver must sell, by order of the law, at 71.11 cents an ounce, non-essential war goods manufacturers will hesitate about using this expensive silver.

Silver Imports Restricted

On July 22, 1942 silver ores, bullion, concentrates, coins, compounds and semi-processed silver items were placed on the restricted imports list in General Imports Order M-63. Only by special permission, applied for on Form PD-222c, is the importation of silver permitted.

Imported Silver Prices

Maximum Price Regulation No. 198 on imported silver bullion, issued on August 5, 1942, provides that no person may import standard commercial bar silver at a price higher than 45 cents per ounce, regardless of existing contracts.

Solder Regulation

Since August 3, 1942, the production and use of wiping solder with 38 per cent tin content may be used by public utilities. This holds until January 1, 1943 in the installation and repairing of lead water service pipes according to Conservation Order M-43-a, as amended June 5, 1942.

Tinplate Restrictions Eased

Canners of tomato pulp and puree have been given permission by the issuance on August 6, 1942 of Amendment 2 to Conservation Order M-81 as amended June 27, 1942 to unlimited use of tinplate or terneplate for packing purposes.

Zinc Limitation Order

Zinc may be used at the rate of 50 per cent of its rate used during the base period, according to the August 15, 1942 Amendment No. 5 to the Limitation Order L-30, in the manufacturing of kitchen and household equipment.

Zinc Pilot Plant Planned

The Bureau of Mines will soon establish a \$350,000 zinc pilot plant and laboratory somewhere in the South-central section of the United States. The daily output of this pilot plant will be about 500 pounds.

Zinc Restrictions

Beginning September first, Order M-11-b, dated July 24, 1942, restricts the use of zinc in the making of such goods as automotive equipment, art craft and furnishings, bicycles and tricycles, beauty shop and barber shop equipment, building supplies and hardware, coin operating devices, cooking and household appliances, clothing accessories, novelties, office supplies, radios, signs, and smokers' supplies.

NEW EQUIPMENT AND SUPPLIES

NEW PROCESSES, MATERIALS AND EQUIPMENT FOR THE METAL INDUSTRY

Plating Solution Control Sets

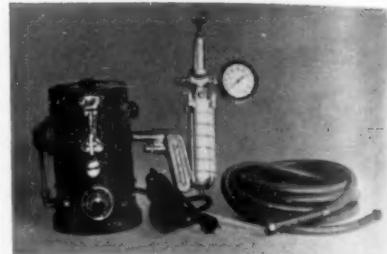
The Research Department of the LaMotte Chemical Products Co., Towson, Baltimore, Md., has developed a new outfit which will enable the operator to make the following control tests: acidity and alkalinity (pH) of all types of baths, chlorides, nickel content, ferrous iron, acid copper, cyanide copper, acid zinc, cyanide zinc, cadmium, brass and bronze solutions.

This outfit is said to be inexpensive and easy to operate, yet the results are accurate in controlling the baths in electroplating and electrotyping. All necessary equipment for making each test is included in a handy case which also includes complete instructions for making each test.

Metal Sprayer

A new, low-cost, self-contained and portable metal atomizer, capable of spraying any neutral alloy which has a melting temperature of up to 600°F for protective coating, reproducing likeness, etc., is offered by Alloy-Sprayer Company, 2040 Book Building, Detroit, Michigan.

The sprayer is recommended for use in making templates, spotting or checking dies, reproducing molds, etc. It is especially suitable where accuracy of reproduction is so fine that even pin scratches must be faithfully reproduced and where the same operation needs a high speed of depositing metal for "backing-up" purposes. The new sprayer, which is simple in design and thoroughly



Self-contained, portable metal atomizer.

foolproof in operation, requires only connecting-in with electric power and factory air pressure line for operation.

No special protection is required for the operator doing work with the sprayer other than that there be adequate ventilation and this is usually arranged so that the sprayed

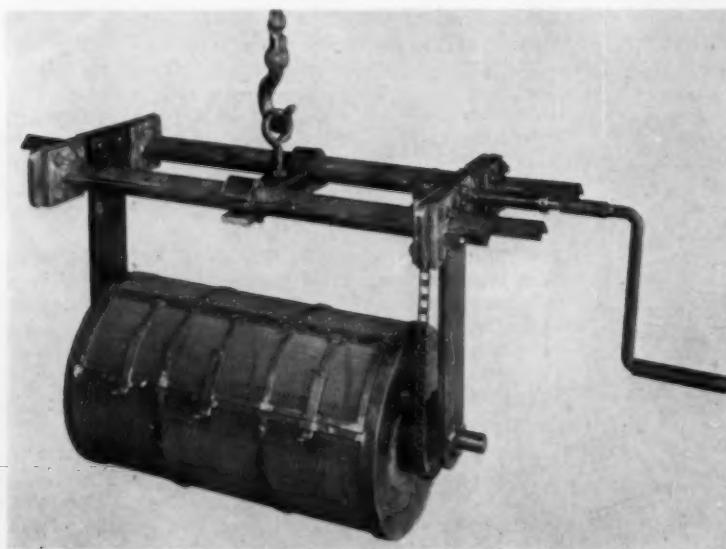
Barrel for Chemical Blackening

The Enthone Company, New Haven, Connecticut, have announced the development of a steel cylinder for chemical blackening of small parts in bulk. A typical barrel is illustrated. Special care was taken in the design of the barrel to eliminate crevices, corners and other spots that could trap the treating solution, in an effort to keep drag-out to a minimum. The entire barrel and drive mechanism are constructed of steel inasmuch as most non-ferrous metals are attacked by the blackening solution. The barrel illustrated is provided with a manual drive which is usually satisfactory inasmuch as only two or three revolutions of

the cylinder are required during blackening.

A three-point suspension is used to facilitate proper line-up of the barrel frame on the top of the treating tank. The drive chain is all large link chain to prevent entrapment of the treating solution. The barrel plus frame assembly is removed from the solution by attaching the lifting hook to a centrally located eye bolt.

The wire screen mesh is varied according to the size of article being treated and the cylinder can be furnished in different dimensions. The cylinder shown is 14" in diameter and 24" long.



Steel cylinder for chemical blackening of small parts in bulk.

Professional Directory

Platers Technical Service Co.	
Electroplating and Chemical Engineers	
Complete services, including solution analyses, process development and deposit tests.	
S. C. Taormina	Tech. Director
Dr. C. B. F. Young	Tech. Advisor
Dr. G. Amorosi	Engr. Advisor
(Professional Engineer)	
59 E. 4th St., N. Y. C.	ORchard 4-1778

G. B. HOGABOOM JR. & CO.	
Consulting Chemical Engineers	
SALT SPRAY TESTING — CERTIFIED TO MEET ARMY AND NAVY SPECIFICATIONS.	Testing of deposits-thickness, composition, porosity. Solution analyses, plant design, process development.
44 East Kinney St.	Newark, N. J.

Joseph B. Kushner, Ch.E.
Metal Finishing Consultant
Plating plants streamlined for defense work.

233 W. 26th St., N. Y. C.

metal can be recovered for re-use. Due to the peculiarity of atomized metal as deposited by this method, the operator doing the spraying can hold light weight work in his bare hands—without any danger of burning his hands.

The sprayer illustrated is a 12-cubic-inch capacity model and is equipped with electrical elements for heating the metal in the heavily insulated pot. Temperature control is variable to suit individual alloys over a range of one hundred degrees by means of a rheostat switch knob on the outside of the pot. A thermostat holds the metal at any pre-set temperature. Latch cover automatically seals the top of the pot against air leakage during the spraying.

Heating the contents of the pot up to the melting point requires approximately 12 minutes after the cord has been plugged in at any convenient outlet. For production spraying, the gun can be kept filled from an auxiliary melting pot.

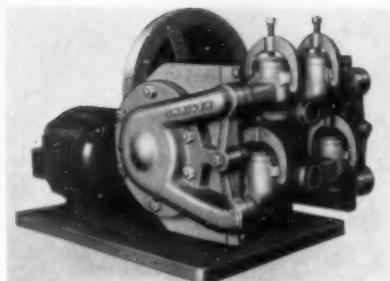
Actual spraying is accomplished by merely pressing the trigger on the handle of the gun, allowing the air to either draw, or force, the metal through the nozzle of the gun. For work requiring extremely fine detail the knob immediately above the handle is turned to close a port into the pot and prevent air under pressure from entering the top of the pot. In this manner, only that amount of metal capable of being drawn off by the ejecting force of the air through the nozzle and working "against the vacuum in the pot" is sprayed. When the port is opened and air is permitted to enter the top of the pot, this additional air pressure combines with the ejecting force and thus increases the amount of metal deposited.

No special training is required on the part of the operator in handling the sprayer. The amount of the coating as it is being applied to the surface of the object being sprayed is easily judged and the continuation of the spraying operation can be continued as indicated.

The sprayer is sold complete with the gun (containing the electrical heating elements, insulated melting pot, control handle and nozzle). In addition, 15 feet of air hose to connect the handle of the gun with the pressure reducer and strainer at the air source and nine feet of cord with plug-in for the electrical connection is supplied with each gun.

New Diaphragm Pump

A new design added to the line of T. Shriver & Co.'s diaphragm pumps is the streamlined top feed, bottom discharge unit which is adapted particularly for handling slurries or suspensions which contain a high percentage of crystalline or quick settling solids which may be corrosive, abrasive, heavy or valuable, delicate or hazardous. The material is fed into the upper manifold through the ball valves and into the heads at each end of the pump in a clean sweeping motion, thereby assuring that with each forward motion of the diaphragm covered piston, the material is forced out through the lower pair of ball valves and out through the lower manifold.



Diaphragm pump adapted for handling slurries.

This does not permit settling or accumulation of solids in the pump heads.

Position displacement of the material is effected by means of the double acting pistons which are always immersed in a bath of lubricating oil. Since the working mechanism is entirely separated from the liquid heads by rubber diaphragms, there can be no effect by the material on the

mechanism. Thus the only parts of the pump which need be made of whatever metal or rubber covered metal that is best suited to the conditions are the liquid heads, ball valves and manifolding.

An interesting feature of the pump is the interchangeability of the valve manifolds so that the pump may be fed from the bottom and discharged at the top, if desired.

The pump is made in a complete range of capacities from 1 to 100 G.P.M. and for delivery pressure up to 100 p.s.i. and a suction lift as high as 18 ft. Any type of motor drive may be applied.

The pump is designed and manufactured by T. Shriver & Company, Harrison, N. J.

Finger Guard

The "Steel-Grip" finger guard, designed and introduced by Industrial Gloves Company of Danville, Illinois, a short time ago, has now been improved for certain types



Improved Process— for Surgical Instrument Manufacturer

Eight years ago, Becton Dickinson and Co., Rutherford, N. J., installed Sylphon Controls on their electro cleaning tanks where metal parts are cleaned prior to plating.

This accurate, automatic control of temperatures immediately permitted stepping-up production and provided more uniform cleaning results, reflected in a better plating job.



The All-Navy
"E" award for
production.

Perhaps you have a similar situation in your own plant where Sylphon automatic control can be an invaluable investment. Over 200,000 Sylphon installations through Industry are evidence of the widespread usefulness of these simple, dependable, inexpensive controls.

Ask a Fulton Sylphon Representative to call or write for Bulletin RA-20.

THE FULTON SYLPHON CO.

KNOXVILLE, TENNESSEE

Representatives in All Principal Cities in U.S.A. and in Montreal, Canada and London, England

PERMAG

Cleaning Compounds



Successfully Serving Industry's Metal Cleaning Requirements throughout the Nation

PERMAG Compounds are daily proving their extremely high value in efficiently cleaning all metals prior to finishing. No trace of grease, smut, oil or dirt can be found on metal parts when cleaned in a PERMAG cleaning solution.

PERMAG helps to insure a fast uniform production schedule which is so necessary for today's war and defense demands.

PERMAG Cleaning Compounds are used at Industrial plants producing:

- | | | |
|----------------------|---------------------------|--------------------|
| ● Aircraft | ● Gun parts | ● Motorcycles |
| ● Airplane Motors | ● Radio Equipment | ● Trucks |
| ● Anti-Aircraft Guns | ● Motor parts | ● Electrical parts |
| ● Cartridge Cases | ● Fire Fighting Equipment | ● Fuses |
| ● Shells | ● Tractors | ● Small Arms |
| | ● Munitions | |

PERMAG Cleaning Compounds are used for removing all foreign particles from aluminum, aluminum alloys, iron, steel, copper, brass, bronze, white metal and zinc alloys.

Never injures soft metal surfaces.

Magnuson Cooperative Service helps solve the tough Cleaning Problems

Laboratory facilities are available, and hard cleaning problems are carefully worked out by an experienced staff. If you have a new and difficult cleaning job write or phone us. We can help you. Interviews involve no obligation on your part.

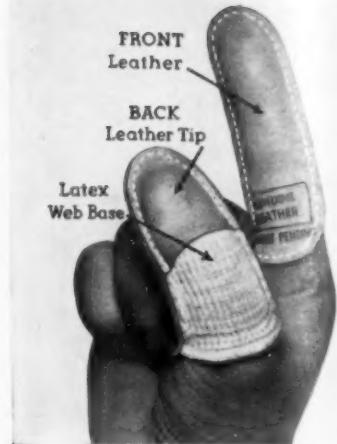
Our warehouses are convenient to your plant, and prompt deliveries are assured.

MAGNUSON PRODUCTS CORPORATION

Mfrs. Specialized Scientific Cleaning Compounds for Every Industrial Purpose.

Main Office: 50 Court Street, BROOKLYN, N. Y.

Representatives from Coast to Coast. Warehouses in Principal Cities.
In Canada: Canadian PERMAG Products Ltd., Montreal and Toronto



Guard featuring leather protection over back of finger as well as front.

of punch press work, sanding, burring, grinding, buffing, assembly, etc.

The new feature in this new design as shown in the illustration, is the added leather section over the back of the finger—at the tip end.

This assures the operator of protection on the back of the finger, (or thumb) as well as the front.

Adaptability for different sized fingers, comfort, flexibility and close cool fit, are obtained by the manufacturer's use of special elastic webbing on the back. This leather finger guard is said to afford long wear and sturdy protection; speed up handling of material and eliminate those minor but costly finger injuries. Used successfully by both men and women on a wide variety of production jobs.

Analytical Sets for Anodizing Solutions

The Kocour Company, 4724 S. Christiana Avenue, Chicago, Ill., have announced the development of analytical sets for rapid analysis of chromic acid and sulfuric acid in anodizing solutions.

A control set, enables anyone to rapidly determine the condition of a sulfuric acid or

Cutting Corners . . . for Top Speed Production

Rounding corners or removing burrs by grinding or filing is too slow and costly to meet today's demands for speed and economy.

Barrel finishing has solved many such problems. Write to us about yours and send a few unfinished samples of your small, metal parts. We'll gladly tell you if they're adapted to finishing with Abbott barrels and materials.

The Abbott Ball Company
1046 New Britain Ave. Hartford, Conn.



Analytical set for anodizing solutions.

chromic acid anodizing solution. Anodizing solutions gradually build up in aluminum salts and thereby decrease in efficiency. Best results and highest efficiency are obtained only when the solutions are properly controlled.

One set, listed as Kocour Analytical Set "STS", is available for the determination of total acid and free sulfuric acid contents and with these factors known, the effective acid is readily calculated.

The other set, listed as Kocour Analytical Set "STC", is for the determination of both total and free chromic acid.

The sets similar to the one illustrated consist of a sturdy wall cabinet fitted with hardware to hold the necessary glassware during use and storage. The glassware was made especially for the set. The solutions are in easily handled bottles, clearly labeled, and so concentrated that very little is used in each test. Most solutions do not deteriorate but those that do can be used and correct results obtained.

Non-Adhesive Protective Film

The United States Stoneware Company of Akron, Ohio, announces the perfection of non-adhesive "Tygon" formulations to provide easily removed, temporary protection to highly polished surfaces against rust, corrosion, grease, finger markings, dust, scratches, etc.

These new formulations consist of pure "Tygon", liquified to form a stable, non-adhesive film when dried. "Tygon" Tempotec, in crystal clear or transparent colored formulations for ready identification purposes, is applied by brush, dip, spray or roller coating. It air dries within a few minutes at normal room temperatures to form a sturdy, durable, elastic film, unaffected by oil, grease, gasoline or corrosive atmospheric fumes or condensates. It will not become brittle under sunlight, is unaffected by active oxidizing agents, water, alcohol or brine solutions.



Protective film can be easily removed from steel surface.

PERMAG CLEANING COMPOUNDS

Available for all

CANADIAN Metal Working Plants

PERMAG Compounds are the latest development in industrial cleaners. Efficient, fast in action, economical; they are manufactured in Canada, ready for shipment by fast transportation to all points.

PERMAG Cleaning Compounds

are used for removing all grease, oil, soil, and smut from metal parts, quickly and efficiently.

PERMAG serves a wide field

Burnishing Compounds
Soap Compositions
Spray Booth Compounds
Paint and Lacquer Stripping Compounds
Wire Drawing Lubricants
Electric Cleaning Compounds
Solvents for Cold Cleaning
Masking Compounds, etc.

PERMAG Cleaning Compounds are used for

Aluminum, aluminum alloys, iron, steel, copper, brass, bronze, white metal, zinc and zinc alloys.

CANADIAN PERMAG PRODUCTS, Limited

Canadian Office and Factory

131 St. Peter St., Montreal, Que.

In U. S. Magnuson Products Corporation, 50 Court St., Brooklyn, New York

Our Canadian Representative will be glad to discuss cleaning problems with you. No obligation for an interview. Write for samples of PERMAG Compounds.

Speed up your war orders with

BLACK-MAGIC

"The one-bath process"



Only 40% of the time and 40% of the cost of any two-bath process and we guarantee equal penetration and better rust-proofing.

BLACK-MAGIC is approved for many Government operations.

Write for portfolio of complete information on Black-Magic and its related products.

THE MITCHELL-BRADFORD CHEMICAL CO.

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A. R. Purdy Co., Inc., New York City Clarence Gush, 1218 Olive St., St. Louis,
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land, Ohio

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Knight Research & Mfg. Co., Buf- cago, Ill.
falo, N. Y.

Lea Manufacturing Co., Waterbury, Conn. Wm. H. Price, Jr. (Divisional Mgr.), 2908 Rising Sun Rd., Ardmore, Pa.

CHROMIC ACID

99.75% PURE

With two complete, independent plants at Jersey City and Baltimore, and its own supply of the basic raw material Chrome Ore from company owned and operated mines, Mutual is the world's foremost manufacturer of Chromic Acid.

BICHROMATE OF SODA

BICHROMATE OF POTASH

Mutual Chemical Co. of America

270 MADISON AVENUE, NEW YORK



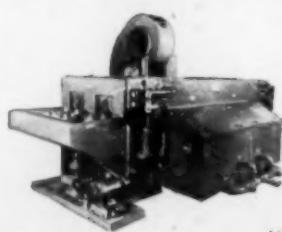
INSULATED PLATING RACKS

Special and Standard Sizes

For all parts regardless of shape. We specialize in your rack problem.

STANDARD PLATING RACK CO.
1925 N. Paulina St., Chicago, Ill.
ARMITAGE 6766

WASHING MACHINES



Magnus 75mm Shell
Washing Machine

FOR
Speedier Production
Better Cleaning
Any Metal, Method or
Size

Let Us Quote on Your Current
Needs

WASHING MACHINE DIVISION
MAGNUS CHEMICAL COMPANY
111 South Ave., Garwood, N. J.

A MAGNUS PRODUCT

The film easily strips free, peeling off as a complete film without danger of injury to the surface beneath.

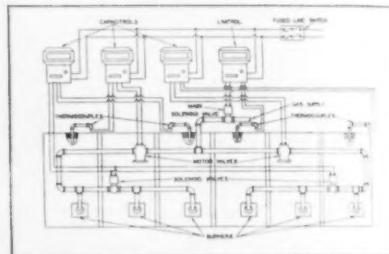
The material is recommended to provide protection for surfaces of machine parts, tools, bearing surfaces, etc., during handling, shipping, installation; it is likewise an effective tarnish preventative for sterling silver, plated silver, nickel or gold, copper and other metals, while in storage, transit or on display.

Temperature Control for Multiple-Burner Oven

A temperature control application designed to maintain even heat throughout a multiple-burner furnace or oven regardless of heat loss at the door or doors, and to give protection against excessive temperature in the event of thermocouple break or upon failure of control apparatus is illustrated in the accompanying drawing prepared by engineers of Wheeleo Instruments Company, Harrison & Peoria Streets, Chicago.

The drawing shows the application adapted to a furnace or oven with doors at both ends, while a modification of this burner and instrument arrangement would provide similar control on equipment with one door.

To replace heat lost at the doors and maintain the entire furnace at even temperature, burners are controlled so that those at the extreme ends burn while those toward the center are out.



Drawing showing application of temperature control to a furnace opening at both ends.

A Complete Line of Requirements for the Electroplating Industry



MUNNING & MUNNING, Inc.
Manufacturers of Electroplating, Buffing, Polishing Apparatus and Supplies.
202-208 Emmet St. Newark, N. J.
Branch Offices: New York, Philadelphia, Woonsocket, R. I.

For a real good polishing job use
KEYSTONE EMERY
Write for Sample
KEYSTONE EMERY MILLS, 4318 Paul St., Phila., Pa.

WORLD'S FINEST PRE-FINISHED METALS • SHEETS & COILS
NICKEL, CHROMIUM, BRASS AND COPPER FINISHES
AMERICAN NICKELOID COMPANY
8 SECOND ST. PERU, ILLINOIS

One temperature control instrument, shown schematically at the left, actuates two solenoid valves installed ahead of the center burners in the furnace. It is actuated by a thermocouple installed at the center of the furnace. Two thermocouples at respective ends of the furnace actuate two other temperature control instruments, which, in turn, operate two motor valves. These valves are installed in such a manner that one controls all burners on one end of the furnace, and the other valve all burners at the other end. The arrangement permits operation of the furnace with a higher temperature at one end than at the other.

When starting up the furnace or oven, both motor and solenoid valves are held open as the instruments call for heat. The two instruments controlling the motor valves, actuated by thermocouples at the ends of the furnace, are set at the temperatures desired within the furnace, while the remaining temperature control instrument, connected to magnetic valves just ahead of the burners within the furnace, is set slightly lower. When the center of the furnace comes to within a few degrees of the desired temperature, the third instrument closes off fuel to the center burners, leaving the end burners holding the furnace to heat by means of the other two instruments.

When operating the equipment on a continuous car-type principle with a temperature at the start of the process or treatment differing from the temperature at the end, control instruments at the ends of the furnace are set accordingly, while the instrument controlling center burners is set at an in-between point.

In either continuous car or batch-type operation, the temperature control arrangement provides the exact temperature desired at all points within the furnace, offsetting heat lost at the door or doors.

Protection against instrument thermocouple or control apparatus failure is provided by a Limitrol, which, when actuated by a thermocouple mounted at the center of the furnace, shuts off fuel supply to all burners by means of a solenoid valve installed in the main gas supply line. This instrument is set a few degrees higher than the maximum temperature indicated by the highest of the temperature control instruments, and shuts down the equipment if this excessive temperature is reached.

Manufacturers' Literature

Acid-Proof Cement

Pennsylvania Salt Manufacturing Company, 1000 Widener Building, Philadelphia, Pa., has announced the issue of Booklet No. 6 on Penchlor Acid-Proof Cement, available to interested companies on request.

The new booklet presents recent data together with photographs and charts showing installations and methods of installation. The "how to use" section has been brought up to date; and chemical, physical and electrical properties are presented in complete detail.

from BRASS to STEEL

for .30 caliber up to 75 MM.'s.
-and cleaned with Wyandotte

- A change from brass drawn cartridge cases to steel cases presents a new cleaning problem—a problem that Wyandotte Engineers have already met.
- Due to the successful work of Wyandotte Cleaning Specialists with pilot line operations, steel drawn cartridge cases are being cleaned rapidly and economically.
- Wyandotte has developed special degreasing compounds for cleaning the steel discs,—for the cleaning operations between draws—and cleaning the drawn case before final plating or lacquering.
- Wyandotte Metal Cleaning and Degreasing Products— together with the experienced service given by Wyandotte Field Engineers—are proving of value to manufacturers of bomb bodies, cartridge cases, projectiles, bomb fins, fuses, pistons, crankshafts . . . There is a Wyandotte Cleaner for every metal cleaning job, and for use in all types of equipment.
- Your Wyandotte Representative is ready to help you, now.



THE J. B. FORD SALES COMPANY, WYANDOTTE, MICHIGAN

BRING YOUR PROBLEMS TO FINISHING HEADQUARTERS

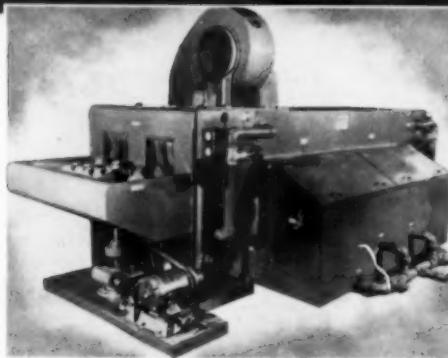
McAleer is the source for all types of finishing materials. McAleer has laboratory facilities and technicians to solve special problems—develop new compounds.

Headquarters for sanding, rubbing and buffing compounds, tripoli, grease stick, rouge, white finish, emery cake and paste.

Distributors Valencia Pumice
Powdered and Lump

McALEER MANUFACTURING COMPANY
ROCHESTER, MICHIGAN

Methods-Materials-Machines



Magnus Shell Washing Machine using Magnus Supersol O for washing, rinsing, cooling and drying 75mm shells. One operator—shells enter and leave at the same end.

**ALL THREE
ARE VITAL
FACTORS
IN
WARTIME
METAL
CLEANING**

You can't consider the cleaning method independently of the metal washing machine or the cleaning material these days. Smooth, high-speed production depends upon the right machine and method. Effective cleaning depends upon the cleaning material—but it must be adapted to the method and the machine.

MAGNUS—A COMPLETE SERVICE

Now you can get the machine best fitted to tie in with your production flow sheet and the cleaning material best suited to your particular products from one organization, geared up to consider your cleaning problem as a whole.

Magnus Materials and Methods, used in a Magnus-designed washing machine specifically built for your own metal cleaning operations, insure maximum production, rigid adherence to quality standards and lowest overall costs.

MAGNUS CHEMICAL COMPANY

Manufacturers of Cleaning Materials, Washing Machines, Industrial Soaps, Sulfonated Oils, Emulsifying Agents and Metal Working Lubricants.

11 South Avenue

Garwood, N. J.

INDUSTRIAL CLEANING CONSULTANTS IN ALL PRINCIPAL CITIES



MAGNUS CLEANERS

UNPARALLELED UNIFORMITY

AS WITH HARRISON'S 4A PRODUCTS

FOR GETTING MORE WORK
FROM YOUR GRAIN
USE

4A CEMENT and THINNER
A Substitute For Glue

NO WORRY ABOUT GLUE SHORTAGE WITH
4A CEMENT AND THINNER. Polishing wheels
are free cutting, long lasting and economical
when set up with 4A Cement.

COLORING ROUGES

UNIFORM, CAREFULLY GRADED RAW MATERIALS, EXPERTLY COMPOUNDED BY HARRISON'S TECHNICIANS, INSURE ROUGES THAT GIVE HIGH LUSTER AND FAULTLESS FINISHES.

POLISHING COMPOUNDS 4A symbolizes those four features which you require for high speed polishing, mirror finishing of all kinds of steel, including stainless steel, carbon steels and hard-to-buff alloys. Use it on any kind of a wheel, soft, medium or hard.

Tell us your problem and samples of compounds, rouges or cement will be sent.

We will be pleased to recommend proper methods.

"AMPLE STOCKS TO TAKE CARE OF OUR TRADE"



HARRISON and COMPANY
Haverhill, Mass.

Analytical Sets for Anodizing Solutions

The Kocour Company, 4724 S. Christiana Ave., Chicago, Ill., have published a sheet describing the company's analytical sets for determining chromic acid and sulphuric acid in anodizing solutions. The sets can be used for rapid determination of both total and free acid.

Bag Type Dust Arrester

Bulletin No. 163-1 of the Northern Blower Co., 6409 Barberton Ave., Cleveland, Ohio, entitled, "Bag Type Dust Arrester", 4 pages with a two-page insert describing the company's bag type dust collecting equipment. Specific arrangement, cloth area and other necessary information are given.

Black Oxide Finishes

The Du-Lite Chemical Corporation, 1 River Road, Middletown, Conn., have just issued an 8-page booklet describing the company's "Du-Lite Process" for blackening steel.

The book gives a history of the development of the process and a description of it covering advantages and equipment required. Special cleaners and rust-proofing oils as well as service rendered by the company are discussed.

The book is illustrated throughout with a variety of steel products which show the finished result of the process.

Colloidal Graphite

Nassau Laboratories, Hackensack, N. J., have a new folder on natural colloidal graphite, copies of which are available to those interested in lubrication. The company's product, "Cograph", made in several grades, is claimed to be a natural graphite of greater fineness than has hitherto been available, for suspension in the thinnest lubricants and liquid fuels. The microscopic particles form a skin over bearing and shaft surfaces, preventing wear, overheating, rust and carbon formations.

Cyclone Dust Collector

Northern Blower Co., Cleveland, Ohio. A four-page bulletin describing the company's dust and fume collectors, both of the wet type. A high efficiency collector where dust is mixed with smoke or fumes. Diagrams and technical data on the units are given.

Data Chart

Canadian Permag Products, Ltd., 131 St. Peter Street, Montreal, have recently issued a handy celluloid data chart. The chart contains the temperature conversion formulae, volume conversion factors, and methods of calculating tank capacities. Copies of this handy chart are available from the company.

Degreasing Solvent

Detroit Rex Products Company, 13009 Hillview Avenue, Detroit, Michigan, has issued two illustrated sheets describing the high stability of "Perm-A-Clor" degreasing solvent under adverse operating conditions. This chlorinated solvent is non-inflammable and is used for cleaning all kinds of metal parts.

Koro-seal

The B. F. Goodrich Company, 500 S. Main Street, Akron, Ohio, has published a hand book of technical information describing the manufacture of Koro-seal and its related products. It also presents the physical, chemical, electrical and processing characteristics of Koro-seal compounds as well as a review of the tests used in determining their properties.

Mounted Wheels

The Chicago Wheel & Manufacturing Company, 1101 West Monroe Street, Chicago, Ill., have just published an illustrated booklet dealing with the proper application of mounted wheels. Exact-size reproductions are given in color of all types of mounted wheels and a wide selection of accessories for use with high speed portable equipment.

Contents of the booklet include a selection guide, giving detailed information on the application of mounted wheels. Another section is devoted to the newly developed mounted polishing wheel.

Molten Salt Baths

"Molten Salt Baths" is the title of a new 72-page illustrated manual published by the Electrochemicals Department of E. I. du Pont de Nemours & Company.

Case hardening of ferrous metals in baths containing sodium cyanide, use of simple cyanide baths as reheat media for high carbon and oil hardening alloy steels and for carbonized work, and nitriding of high-speed steel and other high alloy tool steels in molten cyanide baths are described in the manual.

The company's accelerated salt bath for production of mixed carbon-nitrogen cases on plain carbon and on alloy carburizing steels, and the Du Pont carburizing salt for production of deep cases at usual carburizing temperatures also are described.

Information on heat treating salts for heat treatment of steel and other metals and for heat coloring of finished and polished steel parts is contained in the illustrated manual. There also is information on salt bath equipment, cyanide disposal, modern analytical methods, safety in operation, first aid and medical aid.

Copies of the manual will be sent by the Electrochemicals Department of the Du Pont Company, Wilmington, Delaware, to executives and engineers who request it on their business letterheads.

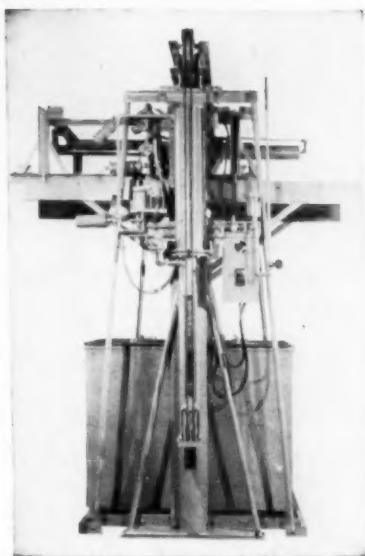
Pickling of Iron and Steel

The Enthone Company, 442 Elm Street, New Haven, Conn., have recently published a 12-page booklet entitled "Modern Pickling of Iron and Steel". This booklet discusses the theory of rust and scale removal, and specific pickling problems such as pickling of springs; electrolytic pickling; and pickling previous to plating, hot galvanizing and tinning. The use of addition agents is also discussed.

Porcelain Enamel

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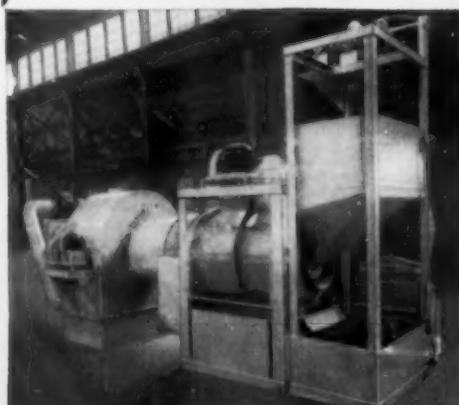
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N. RANSOHOFF, INC.
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CINCINNATI, O.

publisher of a booklet called "Porcelain Enamel" which is sub-titled—"A Non-Critical Finish For War Time Uses".

The booklet describes the general physical and chemical characteristics of porcelain enamel coatings. These characteristics include abrasion resistance, weather resistance, flexibility, resistance to thermal shock and the resistance to specific attack by chemicals and fruit juices.

Rubber Products

The B. F. Goodrich Company, 500 S. Main Street, Akron, Ohio, has issued the "Rubber Guide Book for American War Industries"—a piece of literature dealing with the properties and uses of Ameripol, Koroseal and reclaimed rubber. This booklet is attractively indexed and completely illustrated.

Temperature Control Products

Barber-Colman Co., Rockford, Ill., have published a catalog entitled "Controls for Industry," which contains condensed information on the company's temperature control products for heating, ventilating, air conditioning and industrial applications. Diagrams, drawings and photographs illustrate such products as motor-operated valves, control motors, thermostats, humidity controllers, program switches and accessory equipment which goes to make up the system, and specification data are given.

Associations and Societies

Films of Grand Rapids Convention

Held June 8-10, 1942

Films of the Grand Rapids A.E.S. National Convention are available for showing at Branch meetings throughout the country after September 15, 1942. They were taken by a professional and are offered to the members of the American Electroplaters' Society by The Lea Manufacturing Company as sponsors. The films are a silent version, 16 mm., and should be projected on Bell & Howell or Eastman 16mm. silent equipment. The films are of about 15 minutes duration.

Notice is particularly called to Librarians of A.E.S. Branches throughout the country. Here is a subject which is of extreme interest to members of the A.E.S. whether or not they attended the Convention at Grand Rapids. In the film prominence is given to individual close-ups of men in the industry from all over the country. Many indoor and outdoor shots of excellent composition are shown and will undoubtedly be of interest to all.

Anyone interested in showing these films should write to The Lea Mfg. Co., Waterbury, Conn., as far in advance as possible. There will be no charge of course for the films, the only request of the sponsors being that the people showing the films pay expression both ways.

Business Items

Courses in Electroplating

The Institute of Electrochemistry and Metallurgy, 59-61 East Fourth Street, New York City, will offer specialized courses in the field of electroplating and metallurgy during 1942-43. Registration will be held for the Fall term from September 21st to September 25th and the first class will be held on September 29th. Registration will be held for the Spring courses from February 1st to February 5th inclusive and the first class meeting will occur on February 9th. The following studies will be offered:

FALL COURSES

ELECTROPLATING I.

The course is designed to give the electroplater or industrial worker a foundation in chemistry including qualitative and quantitative analysis. One hour each evening will be devoted to class lectures in which will be discussed the theories of modern chemistry as applied to electroplating. The remaining hours will be devoted to the laboratory where the student will conduct his own experiments. Tuesday and Wednesday from 7:30 to 11:00 P. M. Dr. Young and Mr. Klinsevich. Fee, \$45.00.

METALLURGY I.

The student will be introduced to the structure of metals and alloys and factors are taken into account which affect these, such as temperature, mechanical working, etc. The application of the phase rule to physical metallurgy will be discussed. Both binary and tertiary systems will be studied and illustrated. Heat treating, surface treating and testing of metals and alloys will be studied. Tuesday and Wednesday, 8:30-9:30 P. M. Dr. Young and Mr. Klinsevich. Fee \$30.00.

RESEARCH I.

This course is designed to give the practical electrochemist a chance to investigate problems in his field. One half hour per week is devoted to a conference with the instructor in which the method of attack is laid out. The remaining time is spent in the laboratory where the student applies his knowledge and technique to the solving of problems which arise in such an investigation. Tuesday and Wednesday, 7:00-11:00 P. M. Dr. Young. Fee \$30.00.

INDUSTRIAL MICROSCOPY IA.

This course is specially planned in photomicrographical analysis, general microscopy, and instruction on the metallographic microscope. Subjects covered include the preparation of materials and the proper selection of optical equipment, methods of illumination, control of glare, illumination by incident light, and the use of color filters, special methods of particle-size determination, deter-



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Metso cleaning baths quickly loosen oil, grease, buffing compounds, carbon and other dirt. Just as important as dirt removal is preventing its re-attachment to clean metal.

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mination of refractive index, micrometry, and the proper use of mounting media with respect to its relative refractive index. Work with the polarizing microscope may also be arranged. Mr. Shillaber. Tuition and laboratory fees, \$55.00. Hours to be arranged and announced later.

Time payments may be arranged if desired. For further information call Dr. C. B. F. Young, ORchard 4-1778 or FLushing 9-1685.

Metalwash Machinery Company Opens New Plant at Irvington, N. J.

The Metalwash Machinery Company will remove their main office on or about September first, from the Haynes Avenue plant at Newark, N. J. to their new plant located at 149-155 Shaw Avenue, Irvington, New Jersey.

An increasing demand for the company's equipment has necessitated the opening of a second plant. Here every facility is provided for a greatly enlarged output and an intensified effort in producing special machines that are used extensively in the manufacturing processes of war material under government specifications.

The new Metalwash plant in Irvington, is now in full operation. It is known as Plant No. 1. The other plant at 27-29 Haynes Avenue, Newark, will continue as formerly at production capacity, and is designated as Plant No. 2. At the Irvington plant the general offices of the company are located.

Chester W. Smith has joined the staff of the Detroit Rex Products Company, 13005 Hillview Avenue, Detroit, Michigan, as Research Chemist in the Alkali Division.

Mr. Smith has been a specialist in the field of electrochemistry as applied to electroplating for the past eight years. He was formerly affiliated with the J. C. Miller Company as chief chemist working on research and development of materials for the field of electroplating.

He was 1942 National Convention Chairman for the American Electroplaters' Society, as well as vice-president and librarian of the A.E.S. Grand Rapids branch. He is also a member of the American Chemical Society.

News from California

By Fred Herr

Operators of California metal finishing plants alert to the changing times, whose shops are equipped to handle hard chromium work, are taking advantage of what is regarded as the outstanding truck maintenance development in 1942—the increasing demand for metal spraying and chrome plating of work truck parts.

While this type of work has not been an important factor in the turnover of California plating shops in the past, because until recently it was almost as cheap to get an interchangeable new part, the premium which priorities have placed on truck parts

has expanded chromium plating and spraying operations to a considerable degree during the past several months.

Some of the big trucking companies with fleets large enough to warrant operation of their own machine plants and repair shops are doing much of their own work in rebuilding parts by either the metal spraying or chromium plating methods. Established plating firms which have obtained a considerable amount of this type of work from truck operators are the *Precision Engineering Co.* and the *Southern California Hard Chrome Engineering Co.*, both of Los Angeles; and the *Industrial Hard Chrome Plating Co.* of San Francisco.

Trucking associations in Southern and Northern California have taken note of the development and have cautioned fleet operators of the danger of entrusting chrome work on truck parts to inexperienced operators or to shops not equipped with precision instruments to make accurate measurements of the spray or chrome job so that it will correspond to the original measurements of the parts.

Charles Wallace, head of *California Plating Co.*, 526 East 15th St., Los Angeles, which he operated under lease from C. J. Spence of the *Spence Electropolishing Co.*, 528½ East 15th St., has established an anodizing and cadmium plating shop at 3426 East Olympic Blvd. The new plant, containing 4,000 square feet of floor space, is equipped with 18 tanks. Mr. Wallace cur-

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The New Non-Inflammable Paint Remover

Turco Stripper L-595 answers the demand of safety engineers, for a remover which will completely eliminate fire and health hazards in paint stripping. It fulfills every requirement for safety, speed, economy and ease of application.

Wax-free (saves after-cleaning operation); non-volatile; removes glue; will not attack aluminum, steel, copper, or any other metals; clings to vertical surfaces; removes paint from wood without bleaching or raising the grain; safe in the hands of inexperienced operators; can be brushed or sprayed on.

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A MAGNUS PRODUCT

METAL FINISHING, September, 1942

LUPOMATIC TUMBLING MACHINE CO. INC.
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rently is working with four solutions (chromic acid, silver, cadmium and bright nickel) but announced he will add other tanks as the requirements of the war emergency make them necessary.

Mr. Wallace is one of the veterans of electroplating in Los Angeles, having been active there since 1915.

Cadmium & Nickel Plating Co. has construction underway on a new building adjoining its main plant at 1400 Long Beach Ave., Los Angeles. The new unit, 40x120 feet in dimension, is of concrete and brick construction and is designed to house a new automatic zinc setup with which the firm is expanding its facilities. Work was expected to be completed on the building about September 1.

Oliver Pendley and *A. C. Hays* are the operators of the company. *Robert "Bob" Grip* is the plating superintendent.

The National Sandblasting Co. has been established at 2412½ Santa Fe Ave., Los Angeles, by *Frank and Sam Perino*.

Howard A. Schonbruck and his associates, *John Wiewbiski* and *William H. Jobe*, have founded the *Precision Screw Products Co.*, with headquarters in the Hollywood district of Los Angeles.

Isadore M. Hoffman has been issued articles of incorporation for the *International Bentonite Co.*, to be operated at 269 South Larchmont Blvd., Los Angeles.

The Defense Plant Corp. has approved allocation of \$341,000 to *Western Metal Co.* for erection of a zinc carbonate condenser at Jean, 60 miles south of Las Vegas, Nev. The unit, it is reported, will be capable of treating 48,000 tons of zinc ore per year.

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FOR TIN ELECTROPLATING

SALES AGENT

The R. & H. Chemicals Dep't, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.



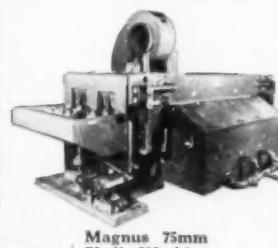
Made from the highest quality selected ores obtainable in this country and in the same careful and thorough manner as imported emerys.

These rough-surfaced solid shaped grains hold unusually well in the glue.

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Any Metal—Any Method—Any Size

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A MAGNUS PRODUCT

A group of Massachusetts investors headed by *Arthur Green* of Boston has announced the proposed development of new molybdenum ore bodies in the *Mono Molybdenum Co.*'s property, near Mariposa, Calif.

Chrome shipments began in July from the Stevenson-McNallen deposits near Oroville, Calif., to the government stockpile near Sacramento. The Metals Reserve Co. is reported to have contracted for receipt of 1000 tons of chrome for the Sacramento stockpile.

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Construction of a chrome concentration plant has been started at Castella, Calif., by the *Montrose Mining & Milling Co.* of San Francisco, which recently acquired the chromite properties in the Dunsmuir field, six miles north of Castella.

Vahan Memleketian has established a shop at 5966 South San Pedro St., Los Angeles under the name of *Memley Plating Works*.

The *Commercial Heat Treating Co.* has been opened for operation at 970 South Alameda St., Los Angeles, by *Thomas S. Stelin*.

W. M. Croner, Fred and David Morrison and *Bert V. Sanders* are associated in the organization of the new *Ferro-Spec Laboratories* at 1514 Nadeau St., Los Angeles.

Sykes Advertising Agency are now located in larger quarters at 505 Empire Bldg., Liberty Ave. and Stanwix St., Pittsburgh, Pa.

Degreasing

U. S. Pat. 2,290,668. W. E. Booth (England), assignor to Imperial Chemical Industries, Ltd., (England), July 21, 1942. A

solvent degreaser for handling metal strip continuously.

FOR **HARD CHROMIUM** USE **ZIALITE** **ADDITION AGENTS**

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2. More durable plate
3. Smoother heavy plate
4. Greater throwing power

Send for samples to test deposit. ZIALITE ADDITION AGENT sample requires several times as long to strip as sample from ordinary chrome bath.

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America's War Conference on Metals!

War has developed new products, new production equipment and new ideas. All of these aids to greater production will be shared when the metal industry meets for the 24th year at the National Metal Congress and a War Production Edition of the National Metal Exposition, the week of October 12, in Cleveland.

Here is your opportunity to discuss your problems with other leaders in the industry. It is your opportunity to see what war metals are adaptable to your production, to study the best in equipment and supplies, to learn how other plants are meeting their war problems.

This is your opportunity—and your responsibility—to help your industry carry forward its giant task of winning this war of metals. You may listen to as many as 100 technical papers presented by the four great cooperating societies. You may attend the numerous war production conferences. You may consult with manufacturers' experts in more than 230 educational displays. Plan to attend this great war conference on metals.

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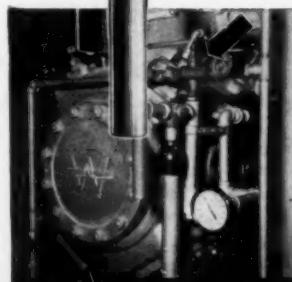
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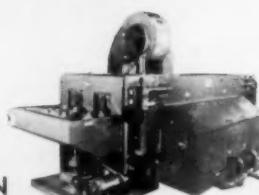
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